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**Urban Mass
Transportation
Administration**

Transit Security: A Description of Problems and Countermeasures

U.S. Department of Transportation
Cambridge MA 02142

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October 1984
Final Report

Technical Assistance - an UMTA Program

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16. Abstract

The report examines transit security problems in the following areas: crimes against passengers and employees; crimes involving revenues, including fare evasion by patrons and revenue theft by employees; and crimes against transit property, including vandalism and graffiti. The transit security countermeasures described in the report include: transit security personnel organizations and activities, security management activities, transit policing activities, and products, equipment and technologies used to provide transit security. The report discusses the problem of selecting cost-effective countermeasures for transit crime problems and the process by which change is implemented within transit security organizations.

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PREFACE

This report, prepared by the Transportation Systems Center (TSC) for the Urban Mass Transportation Administration's (UMTA) Office of Technical Assistance, Safety and Security Staff, provides a broad perspective on transit security. It describes the wide range of security problems encountered by transit systems and discusses some of the methods and technologies used to address these security problems.

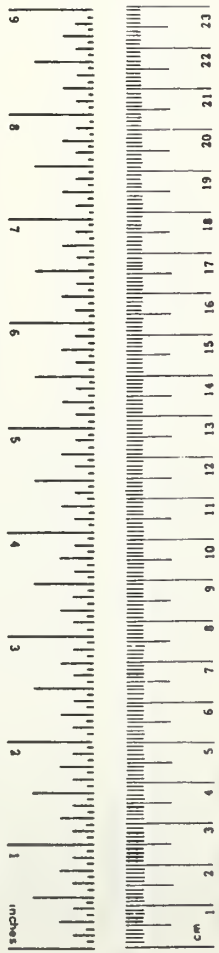
The authors wish to acknowledge the overall guidance and support for this work provided by Lloyd G. Murphy and Gwendolyn R. Cooper of UMTA's Safety and Security Staff during the conduct of this study. It was performed under the general direction of William T. Hathaway of TSC's Safety and Security Division. The authors are also grateful for important contributions made by the following individuals: John E. Cadigan, TSC, who participated in industry contacts and functioned as a technology consultant; Joseph S. Koziol, TSC, who shared his expertise in the fare collection area; Caron Tsapatsaris, formerly of Raytheon Service Company, who participated in the initial planning and industry contacts; and Robert J. Pawlak, TSC, who coordinated the survey of other government agencies and provided valuable comments.

The authors also wish to thank the representatives of the transit industry and APTA for their assistance and cooperation in this effort. Jack Schnell of APTA was particularly helpful in this regard.

METRIC CONVERSION FACTORS

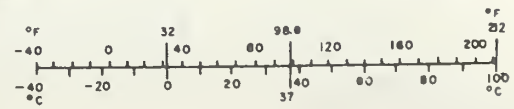
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
AREA				
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
MASS (weight)				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
VOLUME				
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
TEMPERATURE (exact)				
	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
AREA				
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.6	acres	
MASS (weight)				
g	grams	0.036	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
VOLUME				
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
TEMPERATURE (exact)				
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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TRANSIT SYSTEM ABBREVIATIONS

AC Transit	Alameda-Contra Costa Transit District, Oakland, California
BART	San Fancisco Bay Area Rapid Transit District, San Francisco California
BAT	Brockton Area Transit, Brockton, Massachusetts
Bi-State	Bi-State Development Agency, St. Louis, Missouri
CTA	Chicago Transit Authority, Chicago, Illinois
MBTA	Massachusetts Bay Transportation Authority, Boston, Massachusetts
MUNI	San Francisco Municipal Railway, San Francisco, California
NJT-BUS	New Jersey Transit-Bus Division, Maplewood, New Jersey
NJT-Rail	New Jersey Transit-Rail Division, Newark, New Jersey
NYCTA	New York City Transit Authority, New York, New York
PAT	Port Authority of Allegheny County, Pittsburgh, Pennsylvania
RIPTA	Rhode Island Public Transit Authority, Providence, Rhode Island
SCRTD	Southern California Rapid Transit District, Los Angeles, California
SDTI	San Diego Trolley, Inc., San Diego, California
SEPTA	Southeastern Pennsylvania Transportation Authority, Philadelphia, Pennsylvania
STM	Springfield Transit Management Co., Springfield, Massachusetts
WMATA	Washington Metropolitan Area Transit Authority, Washington, D.C.

EXECUTIVE SUMMARY

Mass transit systems have always experienced some crime problems. Recent years have seen an increase in transit crime corresponding to the overall rise in U.S. crime rates. This increased crime has serious consequences for transit systems, particularly when it involves crime against patrons. Such crime has been shown to be a significant factor in the decision not to ride public transportation. In addition to reducing ridership, transit crime may affect the public's willingness to fund transit investments, thus undermining the long-term viability of public transportation.

Although crimes against patrons are a major factor in reduced ridership, vandalism and graffiti also affect the decisions of people to ride transit since they create an impression of lawlessness. Local ordinance violations, such as smoking, drinking, and radio playing, lessen the attractiveness of the system to potential patrons. All these visible breeches of transit security affect public perceptions of the system.

Although less visible to the public, theft of transit property and system revenues also tends to undermine the financial viability of the system. Fare evasion by patrons and fare theft by employees deplete the system of needed revenue. Theft of transit property creates additional expenses through the need to replace equipment and supplies. Although the extent of these security breeches is difficult to determine, losses from these sources can be substantial, and undoubtedly are large in many cases.

Because of the significance of these security problems to the financial and political viability of transit systems, the UMTA Office of Technical Assistance, Safety and Security Staff, has sponsored this assessment of transit security problems and solutions. Building on past research in this area, this report reflects the changing nature of transit security problems and the continuing development of new security programs and equipment.

To gain an overview on transit security issues, site visits were made to 13 U.S. transit systems. Systems were selected to represent a variety of sizes, geographical locations, and modes (bus/light rail/heavy rail). Contacts also were made with nontransit organizations, including government agencies and a

major department store, to learn from their experiences and expertise in the security area. In addition, a literature search was undertaken to draw on existing knowledge in the area of transit security.

The first section of this executive summary describes the principal study findings regarding security problems encountered by the transit systems visited. Patron security, employee security, revenue security, and property security are the major areas addressesd. The second section of the summary describes the ways in which the systems visited attempt to deal with security problems, including policing activities, the use of security-related hardware, and programmatic attempts to cope with transit crime. The concluding section contains general study findings and recommendations for future UMTA/TSC activities to improve transit security.

A. SECURITY PROBLEMS

1. Patron Security

- Although all the transit systems consider patron security to be a matter of primary concern, the extent to which it is a day-to-day problem varies considerably among systems. Crime against patrons is a daily occurrence on some systems; on other systems, it is infrequent.
- Larger urban transit systems operating in high-crime inner-city areas generally experience more crime against patrons than smaller systems or those systems operating commuter-oriented service in suburban areas.
- In general, subways experience more problems with crime against patrons than bus systems.
- Some suburban, commuter-oriented systems have a significant problem with parking lot crime.
- Typical crimes against patrons on large urban systems include robberies and assaults; less common are more serious crimes, such as murder and rape.

2. Employee Security

- Crime against employees is a problem of varying magnitude on transit systems. It can be frequent on large urban systems, but is often rare on smaller systems. Nonetheless, the impacts of such crime, including lost time on the job, the need for compensation payments, and low employee morale, make it a concern for all systems.
- Transit employees, such as bus drivers and station booth attendants, who work in isolated positions are particularly vulnerable to violent acts. These employees are additionally vulnerable because they are the guardians of revenue and because they are the visible enforcers of various transit system regulations, such as payment of fare. Although exact change policies have partially eliminated robbery as a motive for attacks, driver assault is still a serious problem.

3. Revenue Security

- Transit revenue collection is typically a diverse process with many types of fare media and many points at which revenue is collected. Consequently, precise accounting is difficult and losses may go undetected.

a. External Theft of Revenues

- Forcible theft of revenues is not a frequent problem on transit systems, but is a concern due to both the potential for physical violence and the fact that many transit systems are not insured against such losses.
- Robberies and burglaries occur at various points in the revenue collection process. On older systems, change booth robberies are a problem; on newer systems, automatic fare collection equipment has been a target for burglars.
- Robberies of revenue trucks during the transport of revenue from stations or bus garages to the counting room are relatively infrequent, but they are an intermittent problem on some systems. Such robberies are of concern because of the large amounts of money lost.

b. Internal Theft of Revenues

- Theft of revenue by employees is a common problem on all transit systems regardless of size or type.
- Many transit employees who are involved in handling revenue have the opportunity to pilfer, including bus drivers, change booth attendants, station attendants, fare collection equipment maintenance workers, vault or cash box pullers, revenue truck personnel, and counting room employees. Examples of revenue theft by workers in each of these categories were discovered during the site visits.
- Internal theft, particularly small-scale pilfering, may go undetected for long periods of time because of its covert nature and the general lack of precise accounting. Consequently, internal theft is often overlooked by management. Although amounts pilfered on a day-to-day basis are small, cumulative losses may be large.
- Large-scale internal theft does occur occasionally.

c. Fare Evasion

- Fare evasion is a pervasive problem on transit systems regardless of size or type. The extent of the problem is difficult to determine, although some officials report having sizeable problems.
- Methods of fare evasion include outright refusal to pay, paying less than full fare, counterfeiting fare media, and misuse of existing media.
- Newer systems, using automatic fare collection equipment, are not immune from fare evasion problems; patrons have devised many ingenious ways to circumvent these fare collection systems.
- Fare evasion, like employee theft, can easily be ignored by management because of its covert nature.

4. Property Security

- Vandalism and graffiti are problems on transit systems of all sizes. The extent of vandalism and graffiti seems to be as much a function of the system's efforts to control it than the size or type of system. Some systems have the resources and motivation to keep vandalism largely under control; others appear to be fighting a losing battle.
- There is some evidence that vandalized property invites more vandalism and that, conversely, keeping vehicles and facilities in good repair serves as a preventive measure.
- Theft of transit property by employees is a problem of unknown dimensions. A number of systems acknowledge incidents of such theft and some have initiated countermeasures, but overall this security area is not given high priority. Lack of good inventory control at many systems contributes to the problem.
- Theft of property by persons outside the transit system does occur, but seems to be a relatively minor problem and is more easily controlled than internal theft.

B. SECURITY COUNTERMEASURES AND PROGRAMS

1. Policing Activities

- All transit systems need to rely upon sworn police officers for situations in which arrest power is necessary. Large urban systems tend to have their own transit police forces or use of special transit units within municipal police departments. Smaller systems often have no security personnel of their own but rely on local police when dealing with situations requiring arrest powers. Other systems hire off-duty municipal officers or private security forces.
- The use of police officers, however, is usually confined to the protection of patrons and employees. Protection of property and revenues often is the responsibility of security guards or other transit system employees.
- Most transit police forces are guided by standard operating procedures, but the existence of long-range security plans and emergency procedures are more the exception than the rule.

- Although most transit police departments maintain good records of criminal incidents, only a few of the systems visited use crime statistics to deploy police officers and to guide security planning.

2. Security Equipment and Technology

- Closed circuit television (CCTV) is used by many transit systems to protect patrons, property, and revenues. The extent of its use and opinions regarding its effectiveness vary widely. Areas where its use appears to have a discernibly positive impact include surveillance of revenue counting activities and station security, at least as perceived by transit patrons.

- Two-way radios are in use at all systems visited. In addition to their use by patrol officers, these radios are used by bus and train operators to communicate with a control center. Although their main function in this case is to monitor system operations, they also serve an important security function by allowing vehicle operators to call for assistance. Two-way radios represent a fundamental advance in improving transit security by facilitating communication within the system.

- Silent alarms, which are standard equipment on buses at many systems visited, allow the drivers to signal trouble on a bus without alerting those on board. The simplest alarms activate flashing lights on the bus exterior. More complex alarms transmit a signal to the dispatcher indicating a problem on a specific bus. The operational efficiency of silent alarms, particularly the issuance of false alarms, is a major problem limiting their usefulness.

- Use of computerized management information systems (MIS) to compile transit security data is limited at present, but appears to be expanding rapidly. This expansion is related to the increasing general use of computers by transit systems. For example, a few larger systems use computerized crime statistics to deploy security forces. Some bus systems with electronic registering fareboxes use computerized MIS systems to establish an audit trail of revenues from farebox to bank. Other security-related uses of MIS include inventory control and cost accounting for vandalism and graffiti losses.

- A number of security measures that relate specifically to the protection of revenues were encountered during the study. Electronic registering fareboxes on buses help reduce fare evasion and can be used to establish an audit trail of revenues. Vacuum systems remove revenue from bus fareboxes without the intervention of human hands. Pocketless uniforms worn by counting room employees make it more difficult to conceal money. Surveillance cameras in counting rooms increase revenue security by deterring and detecting revenue theft.

- A number of more mundane security measures, such as improved fencing, lighting, and locks, are being implemented at many of the systems visited. Although less expensive, these measures may be as cost-effective as the more sophisticated countermeasures.

3. Security Outreach Programs

- Outreach programs that involve the public in transit crime prevention have been instituted at transit systems. Many systems have school programs that teach children to ride the system safely and explain why vandalism is expensive and dangerous. Other outreach efforts mentioned include community programs to make the public more conscious of transit crime and how to avoid it, to involve the public in reporting transit crime, and to reduce fare evasion.

- Efforts to communicate with and involve representatives of the legal system are an important part of transit crime deterrence. Unless offenders are prosecuted, an air of permissiveness will develop, which encourages further criminal activity. Judges typically do not give transit crime a high priority because of their heavy case load and the serious nature of many nontransit crimes before the court.

  Some transit systems have made efforts to communicate to judges the cumulative effect of transit crime and the consequent need for stricter enforcement. There also has been discussion of establishing special courts to deal exclusively with transit crime. Careful record keeping to identify repeat offenders is also useful in obtaining prosecution through the courts.

CONCLUSIONS

- There is substantial evidence that transit security represents a large, multi-dimensional problem which seriously detracts from the continued viability of public transportation.
- The financial and social costs of transit security violations are borne by transit riders as well as by the public at large.
- Lack of quantification is a problem which pervades the area of transit security. Most transit systems record individual crime incidents, but few compile aggregate crime statistics. Few systems maintain statistics on losses from fare evasion, revenue theft, property theft, or vandalism.
- Better quantification would make transit officials more aware of existing problems and would allow them to make more rational decisions regarding the implementation of new procedures, programs and technologies. In addition, it would allow more precise estimation of the dimensions of the transit security problem on a national level.
- Most transit security activity is reactive, responding to a particular problem. Programs that deal systematically with problems and solutions are more the exception than the rule.
- Although some information sharing does occur, many systems implement security countermeasures without interaction with others in the transit industry. More information sharing among transit officials would help to disseminate innovative security ideas and techniques.
- Significant improvements in transit security could be obtained by fuller utilization of those countermeasures already developed and available to transit systems.

RECOMMENDATIONS

- UMTA should promote greater quantification of transit security information by encouraging systems to maintain comprehensive automated records and by encouraging some form of national reporting system for transit crime statistics.

- UMTA should conduct further studies to (1) quantify the financial and social costs of transit crime, (2) identify countermeasures to address transit crime, and (3) establish the impact of particular security countermeasures on transit crime.
- UMTA should undertake cost/benefit studies to determine the relative value of various security countermeasures thereby assisting transit systems in deciding which measures to implement in "real world" situations.
- UMTA should act to enhance the exchange of information on transit security problems and countermeasures within the transit industry.

1. INTRODUCTION

This report, prepared for the Urban Mass Transportation Administration's (UMTA) Office of Technical Assistance, Safety and Security Staff, provides a broad perspective on transit security. It describes the wide range of security problems encountered by transit systems and discusses some of the methods and technologies used to address these security problems. A primary focus of the report is transit crime that is highly publicized and apparent to passengers and consequently has a detrimental effect on transit ridership. In addition to covering security topics that are "visible" to patrons, the report also addresses internal security subjects such as facility protection and the integrity of the revenue system. Finally, the process of change is discussed to establish a framework for encouraging improvements in transit security.

A common theme discussed throughout the report is the systems approach to transit security. The basis of the systems approach is that all elements of a unit are integrated. Within the context of transit security, adherence to a systems approach would necessitate careful consideration of the total impact of a security or non-security process or technology change on the overall security of the transit system.

This study is an initial effort to identify security problems and available countermeasures. Findings and recommendations will provide a basis for the establishment of a security program to systematically address transit security needs.

1.1 BACKGROUND

Security is the condition that exists when the laws of society regarding the protection of people and property are observed. For the purposes of this report, transit security is defined as the freedom from injury, loss, or damage due to a deliberate act of violence, theft, or vandalism within the mass transit environment. The mass transit environment includes transit vehicles, stations, and rights-of-way, bus stops, revenue collection trucks, bus and train yards, cash counting rooms, and other transit-related facilities.

There is among transit professionals an awareness that crime is a problem and one purpose of this report is to define in both qualitative and quantitative

terms the extent of this problem. In describing crime, it is common practice to begin with the Federal Bureau of Investigation's (FBI) Uniform Crime Reporting (UCR) Program. Under the UCR Program, the FBI collects and publishes crime statistics for the U.S. Local, county and state law enforcement agencies submit data to the FBI using a consistent set of categories and definitions. Criminal offenses are divided into two categories, based on their severity, Part I and Part II crimes. Part I offenses include the more serious crimes: criminal homicide, forcible rape, robbery, aggravated assault, burglary, larceny, motor vehicle theft and arson. Part II crimes include less serious criminal acts such as simple assaults, counterfeiting, fraud, vandalism, prostitution, drug abuse and drunkenness.

While the FBI categorization will be followed in this report, it is also useful when discussing transit security to add a third category, local ordinance violations. The Southeastern Michigan Council of Governments (SEMCOG) has conducted two surveys of transit crime and has used local ordinance violations as a category to include prohibited acts such as radio playing, smoking, and eating on board transit vehicles. These violations, although less serious than Part I and Part II crimes, are also an important concern for transit systems.

While the FBI UCR Program and the SEMCOG surveys provide a framework for discussing transit security problems, neither offers industry-wide measures of transit crime. The UCR statistics fail to distinguish transit crimes from general street crimes; therefore they cannot be used to describe levels or trends of transit crime. The SEMCOG surveys, while limited to transit crime, provide data for only two years and include only a subset of U.S. transit systems. This absence of comprehensive data is due in part to jurisdictional variations. Some transit systems have legally constituted police departments that report under the UCR Program, but in most cities, transit systems have no separate police units and hence no reporting of crime statistics.

1.2 STUDY METHODOLOGY

In preparing this study a literature search was undertaken to draw on existing knowledge in the area of transit security. Subsequently site visits were conducted at 13 transit systems selected to represent a variety of sizes, geographical locations, and modes (bus, light rail, heavy rail). A standard

questionnaire was used during the site visit interviews. A copy is attached as an appendix to this report.

Contacts were also made with nontransit organizations, including government agencies and private companies, to learn from their experiences and expertise in the area of transit and security.

The individuals contacted during this study were knowledgeable, dedicated, and cooperative. Their contributions were essential to this study but they bear no responsibility for the information and conclusions presented.

The thirteen transit systems visited by the authors are:

- AC Transit (Alameda-Contra Costa Transit District) which provides bus service to Oakland, California and the surrounding area
- BART (Bay Area Rapid Transit), a heavy rail system in the San Francisco Bay region
- BAT (Brockton Area Transit), a bus system servicing Brockton, Massachusetts and the surrounding area
- MBTA (Massachusetts Bay Transportation Authority), a multi-modal system providing bus, light rail and heavy rail service to the metropolitan Boston area
- MUNI (San Francisco Municipal Railway), providing bus and light rail service in San Francisco
- NJT-Bus (New Jersey Transit-Bus Division), operating bus transportation throughout the state and a single line light rail system in Newark
- NJT-Rail (New Jersey Transit-Rail Division), responsible for most public rail transportation within New Jersey
- NYCTA (New York City Transit Authority), which provides bus and rail service throughout New York City
- RIPTA (Rhode Island Public Transit Authority), based in Providence, operates buses throughout Rhode Island
- SDTI (San Diego Trolley, Inc.), a light rail transit system servicing downtown San Diego and the area south to the Mexican border
- SCRTD (Southern California Rapid Transit District), provides bus service to the Los Angeles metropolitan area
- STM (Springfield Transit Management), a bus system that operates in Springfield, Massachusetts

- WMATA (Washington Metropolitan Area Transit Authority), providing bus and rail service in the Washington DC region

Table 1-1 provides some basic information for each of these thirteen systems.

TABLE 1-1. BASIC INFORMATION FOR THE TRANSIT SYSTEMS VISITED

SYSTEM	NUMBER OF VEHICLES	NUMBER OF EMPLOYEES	ANNUAL PASSENGERS	ANNUAL REVENUES
AC TRANSIT	997	2,187	109M	$ 84M
BART	439	1,759	50M	115M
BAT	66	153	4M	5M
MBTA	1,905	6,726	251M	269M
MUNI	1,110	3,714	262M	124M
NJT-BUS	1,957	4,210	154M	216M
NJT-TRAIN	750	1,400	34M	63M
NYCTA	10,871	46,542	2,498M	1,715M
RIPTA	267	533	20M	8M
SDTI	24	75	5M	4M
SCRTD	3,362	7,910	389M	338M
STM	118	157	7M	5M
WMATA	2,300	6,904	283M	373M

SOURCES: Site Visits, UMTA Section 15 Reporting, SEMCOG.

Questionnaires regarding security activities were sent to the following branches of the U.S. Department of Transportation:

- The National Highway Traffic Safety Administration (NHTSA)
- The Federal Highway Administration (FHWA)
- The Federal Aviation Administration (FAA)
- The United States Coast Guard (USCG)
- The Federal Railroad Administration (FRA)

Discussions were held with representatives of the following U.S. Department of Defense branches:

- The Defense Contract Administration
- The Electronic Systems Division at Hanscom Air Force Base

Conversations and meetings were held with representatives of the American Public Transit Association (APTA). In addition, members of the study team attended APTA Security Committee meetings, which allowed for contact with a wide variety of transit security industry officials and spokespersons from private industries that market products relevant to transit security.

Finally, conversations were held with representatives of the following organizations:

- Filene's Department Stores
- Duncan Industries
- Dynatrend, Inc.
- Lincoln Laboratories
- Mitre Corporation
- ATE Management and Service Company, Inc.
- The Federal Reserve Bank
- The International Bridge, Tunnel and Turnpike Association, Inc.
- The Highway Research Board
- The National Auto Theft Bureau

It should be noted that while this report attempts to maintain a broad perspective on the subject of transit security, some useful information undoubtedly was not included due to various study limitations. In addition, the interview process may have resulted in the recording of some inaccurate or unsubstantiated information. The authors apologize for any omissions or inaccuracies.

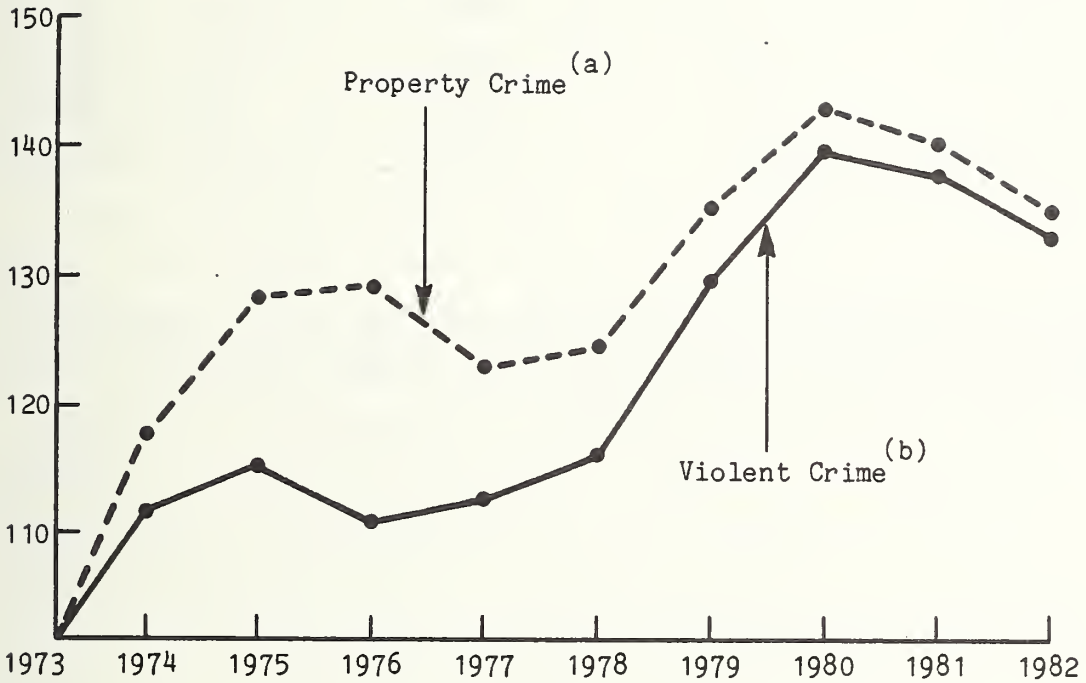
2. AN OVERVIEW OF CRIME AND ITS IMPACT ON TRANSIT SYSTEMS

The problems of transit crime can best be understood within the context of crime in society. Because transit systems naturally operate within the confines of society, they often prosper from the same amenities and suffer from the same shortcomings. One shortcoming that must be confronted by both society and the transit industry is crime. The two are clearly related; transit crime is not an independent phenomenon, but is a variant of societal crime. In that crime is pervasive in our society, it follows that crime will also be a transit problem. This chapter briefly examines the extent of crime as a problem in the U.S and describes the current level of crime on mass transit. In addition the costs, both financial and social, of transit crime are discussed.

2.1 CRIME IN THE UNITED STATES

While the causes of crime are often debated, the implicit assumption is that crime is a deeply ingrained characteristic of our society. In the U.S. crime has been both a serious and rising problem. Figure 2-1 illustrates the percentage increase in property and violent crime levels from the base year of 1973 to 1982. Since 1973, property and violent crime levels have increased over 30 percent,[1] although since 1980 there has been a slight decrease in the overall crime rate.

Crime, especially violent crime against persons, occurs most frequently in larger urban places, i.e., places where public transit is most common. This relationship is illustrated in Table 2-1. In 1981, the category of the largest cities, those with populations of more than 250,000, suffered from a violent crime rate nearly five times greater than that of small cities with less than 10,000 people. This pattern also holds true, albeit much less dramatically, for property crime. In 1981, the largest cities had a property crime rate nearly twice as large as that of the category of smallest cities. This pattern remains consistent through all city size categories between 10,000 and 250,000, thus indicating that over this range a positive relationship exists between city population and crime rate. This relationship cannot, however, be viewed as strictly causal. While highly populated cities do report high rates of crime, it is the socio-economic characteristics of these cities, such as population density, income distribution, and unemployment levels, that contribute to crime, and not simply population size.



Source: Crime in the United States, 1982, U.S. Department of Justice, Federal Bureau of Inventigation, Table 2, p. 43.

(a) Property crime includes the offenses of burglary, larceny-theft, and motor vehicle theft.

(b) Violent crime includes the offenses of murder, forcible rape, robbery and aggravated assault.

FIGURE 2-1. INDEX OF U.S. CRIME RATES (1973 = 100)

TABLE 2-1 CRIMES PER 100,000 INHABITANTS BY CITY POPULATION SIZE, 1981

City Population Size	Violent Crime	Property Crime	Total Crime
250,000 and over	1,441	8,030	9,471
100,000 - 249,999	826	7,495	8,321
50,000 - 99,999	584	6,371	6,954
25,000 - 49,999	452	5,858	6,310
10,000 - 24,999	342	4,936	5,278
Under 10,000	291	4,466	4,757

Source: Crime in the United States, Uniform Crime Reports, (1981), published annually by the U.S. Department of Justice, Federal Bureau of Investigation, Table 13, pp. 144-145.

2.2 THE CURRENT LEVEL OF TRANSIT CRIME AND SECURITY PROBLEMS

Given that mass transportation is principally an urban activity, it would not be surprising to discover that the transit industry shares the crime problems of major cities. In a comparison of transit crime with street crime, Siegel concluded that transit crime reflects the environment; increases in transit crime parallel increases in street crime.[2] In addition to operating within an urban, more crime-oriented environment, there are other characteristics of mass transit that make it vulnerable to crime. Large amounts of cash are collected, stored and handled each day; and people of widely different social strata are routinely crowded together. Such conditions are attractive to those intent on unlawful behavior.

Prior to the 1960's mass transit crime was not considered to be a major problem. Most breaches of security were confined to pickpocketing, minor vandalism and fare evasion. There were some armed robberies of drivers but assaults on operators and passengers were rare.[3]

Beginning in the mid-1960's highly publicized waves of violent transit crime occurred in a number of large cities. In addition, the rate of vandalism was rapidly rising. This combination of factors triggered a widespread public concern regarding the security of mass transit patrons. The immediate response to this concern in the larger cities was to utilize police saturation in the most affected areas of the system to regain the confidence of the public. Saturation proved to be an effective crime deterrent within its immediate range. However, this approach was also costly and its long-term benefits were questioned as crime rates grew in unprotected areas.

Transit systems turned to other less expensive crime prevention activities such as dog patrols, fixed and riding watch posts, random mobile patrols, stakeouts, decoy units, community relations programs, and liaisons with local schools. In some cases these programs were assumed to be effective individually, but their overall impact on transit crime is not known, and no conclusions can be made. Various police activities and technologies can be used, individually or in combination, to address particular security problems. A wide variety of such activities and technologies has been used or tested; however, no consensus regarding the optimal combination of interrelated programs and hardware has been reached. The literature does indicate that there is one security activity that

far exceeds all others in terms of passenger preference, and that is police saturation. Transit riders simply feel more secure in the presence of a uniformed officer.[4]

In addition to policing activities, new types of security equipment were installed in an effort to secure stations and vehicles. This new security equipment includes two-way radios, digital computer systems, closed circuit television (CCTV), emergency only telephones, publicly activated alarms, employee activated silent alarms, and flashing emergency lights on the exterior of vehicles.

Despite these efforts, transit crime remains a serious concern throughout the country. The most recent assessment of mass transit crime was undertaken by the Southeast Michigan Council of Governments (SEMCOG). SEMCOG summarized the current mass transit crime situation as follows:

> "It is evident that transit crime is a national problem of MAJOR PROPORTION which cannot be ignored in terms of the seriousness and/or frequency with which offenses are committed. It would also appear that neither small nor large systems are immune from the impact of crime on ridership and passenger safety."[5]

As surveyed by SEMCOG, 57 transit systems located throughout the country reported a total of 278,456 transit related offenses in 1980 (see Table 2-2). The majority of the offenses reported were local ordinance violations which typically include fare disputes and smoking, eating and playing radios aboard the vehicles. Part II crimes, including a large amount of vandalism and fraud, follow as the second largest group of offenses reported. The most serious or Part I crimes such as aggravated assault, robbery, rape and murder accounted for only 11.3 percent of reported incidents. However, this relatively small percentage does represent 31,333 serious mass transit crimes that occurred in 1980. It should be noted that the focus of the SEMCOG study was on relatively large urban transit systems. These figures are representative only of the systems sampled and not all U.S. transit systems. In that the sample is weighted toward large urban areas and these areas have a higher rate of Part I offenses in general, the SEMCOG results for mass transit crime probably exaggerate the prevalence of Part I offenses.

TABLE 2-2. TRANSIT CRIME AT FIFTY-SEVEN U.S. TRANSIT SYSTEMS IN 1980

Part I Crimes	31333	11.3%
Part II Crimes	91728	32.9%
Local Ordinance Violations	155,395	55.8%
Total	278,456	100.0%

Source: SEMCOG, pp. 19-20.

Mass transit crime is a major problem that appears to be increasing. The SEMCOG study provides crime figures for 39 transit systems for both 1977 and 1980. These figures show an increase in transit security violations of 21.3 percent throughout the 39 systems.[6]

The fact that transit systems differ in such factors as operating policy, density and demography of population, and hours of operation makes it difficult to compare crime rates across systems. In addition, crime reporting procedures are not standardized and some systems are more diligent record keepers than others. Despite these problems some generalizations regarding transit crime differences among systems can be made. Most violent or serious crimes occur in the large, metropolitan transit systems. A positive relationship exists between transit crime and the level of crime in the surrounding area. Another generalization is that rail systems tend to have higher crime rates than bus systems. This is partially due to the fact that rail systems are confined to large, generally less secure cities. A major exception to this rule are rail systems that primarily provide commuter services transporting people from the suburbs to the inner city.

In sum, virtually all transit systems are subject to a variety of criminal activity, but this problem appears to be most serious in major metropolitan areas. New policing methods and technologies have been utilized in an attempt to increase transit security, but their impact has been limited as users and potential users continue to cite a lack of security as a major problem with mass transportation.

2.3 THE COSTS OF TRANSIT CRIME

As illustrated in Table 2-3, transit crime has both financial and social costs. The financial costs, directly borne by the systems themselves but indirectly passed on to patrons and tax payers through higher fares and higher taxes, reductions in the frequency and quality of service, and higher government subsidies, can be divided into two categories: the increased financial burden of operating the system, and the reduction of revenues collected and deposited by the transit system. The social costs are borne by both patrons who suffer from reduced security within the system, and nonpatrons who must contend with

congestion outside the system as potential passengers concerned about a lack of security turn to other forms of transportation.[7]

Security officials at a number of systems report that, in some cases, these costs can be substantial. While no estimates of the nationwide financial costs of transit crime exist, specific data points that are available do indicate that the amount lost is not insignificant. For example, officials at MUNI estimated that $5.7 million per year is lost to fare evasion at that system.[8] This figure represents over 12 percent of all revenues collected from passengers at MUNI in a single year. While it is beyond the scope of this report to quantify transit system costs due to transit crime, such information, when available, has been included in Sections 3.0 and 4.0.

TABLE 2-3. THE COSTS OF TRANSIT CRIME

FINANCIAL COSTS	
INCREASED OPERATING COSTS	REDUCED REVENUES
• Physical property damaged by vandalism and graffiti must be replaced or repaired	• Cash is stolen from the system by outside sources
• The threat of security violations to passengers and property forces the system to increase outlays for police and surveillance activities	• Transit employees steal transit revenues • Patrons evade the payment of fares • An atmosphere of insecurity discourages potential patrons from using the system

SOCIAL COSTS
• The overall quality of urban life is reduced as one's sense of insecurity increases
• To the extent that crime discourages ridership, commuters increase automobile use and streets become more congested, pollution levels rise, and alternative forms of transportation become more costly

3. TRANSIT SECURITY PROBLEMS

Transit crimes are not isolated events; they do not occur independent of each other. There are a wide variety of transit security problems and some have a much greater impact than others, but none can be ignored. Allowing any transit security problem to persist weakens the entire system by encouraging the escalation of the problem and the development of others. For example, it is unwise to tolerate a small amount of graffiti. By allowing some graffiti to occur and remain on vehicles and in stations, the transit system signals to other potential graffiti artists that this form of vandalism is acceptable behavior, and the graffiti problem will gradually worsen. Other forms of vandalism and violations of local transit ordinances may follow, increasing the atmosphere of lawlessness and encouraging further security violations of potentially greater severity.

Leniency in cash collection and handling procedures also can lead to more severe security problems. A fare evasion that passes unchallenged may encourage others to begin evading fare payment. Lax revenue handling procedures among transit employees convey a sense of irresponsibility that suggests that minor skimming by cash handling employees will be tolerated. This minor skimming can easily escalate into more serious employee theft of revenues as time passes.

Transit security problems can be categorized as follows:

- Passenger security
- Employee security
- Revenue security
- Transit equipment and property protection
- Internal fraud prevention

Passengers and employees need to be protected from personal crimes such as assault, sexual attacks, robbery, larceny, harrassment and abuse. Revenues must be protected; security personnel need to safeguard the system from both fares never deposited due to fare evasion and the theft of revenues collected by either persons outside the system or employees of the system. Transit property, including vehicles, stations, right-of-way, equipment and tools must be guarded. Finally, internal fraud must be prevented. In this chapter each of these five security responsibilities will be discussed individually. Areas of security vulnerability will be described and examples of specific security violations gathered from our site visits will be presented.

3.1 PASSENGER SECURITY PROBLEMS

The leading security priority of any transit system is the protection of passengers from crime. Crime against transit patrons can involve serious (Part I) offenses, less serious (Part II) offenses, or local ordinance violations. Each transit system suffers from its own unique blend of these security problems. Table 3-1 presents the most commonly occurring Part I and Part II crimes reported by the 57 transit systems surveyed by SEMCOG.

Of the total Part I offenses reported to SEMCOG, larceny was the most prevalent followed by robbery and aggravated assault. The two primary Part II offenses reported by the respondents were vandalism and drunk and disorderly conduct. Only the latter is a crime against passengers. Vandalism is principally a crime against transit property, but passengers who regularly must cope with the products of vandalism such as slashed seats, broken windows and graffiti might disagree.

In a discussion of mass transit crime at individual transit systems, one generalization tends to stand out: the level of mass transit crime mirrors the crime rate of the surrounding area. Mass transit systems located in high crime areas generally experience high levels of transit crime. In addition, transit systems servicing broad metropolitan areas will experience their most severe crime problems in those areas where crime is most prevalent. In that the largest transit systems typically service the most densely populated and crime-ridden areas, it follows that these systems will have the greatest crime problems. Table 3-2 illustrates this relationship between the size of the transit system and the relative frequency of various transit crimes against passengers. Although efforts to collect crime information yielded only a small amount of numerical data, discussions with security officials at the transit systems visited and a review of the literature, especially the SEMCOG assessment of mass transit crime, provided sufficient information to make comparisons among systems of different sizes. Numerical values are indicated for the terms "rare," "occasional," and "common" to give the table some order of magnitude. However, the primary purpose is to illustrate the relative frequency of certain crimes within and among the three different size categories, and the terms utilized in Table 3-2 should be interpreted accordingly.

TABLE 3-1. THE MOST COMMON PART I AND PART II TRANSIT CRIMES REPORTED AT 57 TRANSIT SYSTEMS

PART I CRIMES		PART II CRIMES	
Crime	%	Crime	%
Larceny[a]	58.4	Vandalism	34.8
Robbery[b]	25.2	Drunkenness and Disorderly Conduct	22.1
Aggravated Assault	6.4		
Other[c]	10.0	Other[d]	43.1

Source: SEMCOG, July 1981, pp. 24-27.

(a) Larceny is the unlawful taking of property from the possession of another (without use of force).

(b) Robbery is the taking of anything of value by force or threat of force.

(c) Other Part I crimes include murder, rape, burglary and motor vehicle theft.

(d) Other Part II crimes include simple assault, arson, stolen property, sex offenses, drug violations and fraud.

TABLE 3-2. FREQUENCY OF CRIME BY TRANSIT SYSTEM SIZE

Category of Crime	Size of Transit System		
	Large (>100 million passengers)	Medium (20-100 million passengers)	Small (<20 million passengers)
Murder	●●	●	●
Rape	●●	●●	●
Aggravated Assault	●●●●	●●●	●●
Other Sex Offenses	●●●●	●●	●●
Robbery	●●●●●	●●●	●●
Simple Assault	●●●●●	●●●●	●●
Larceny	●●●●●●	●●●●●	●●
Drunk and Disorderly Conduct	●●●●●	●●●●●	●●●●
Local Ordinance Violations	●●●●●●●	●●●●●●	●●●●●

Legend

Common(a)	●●●●●●●	Infrequent	●●●
Very Frequent	●●●●●●	Very Infrequent	●●
Frequent	●●●●●	Rare(c)	●
Occasional(b)	●●●●		

Sources: Site visits and SEMCOG (July 1981)

(a) More than ten per day
(b) Approximately one per week
(c) Less than one incident per year.

Table 3-2 reflects the tendency for larger transit systems to have more serious crime problems in terms of both frequency and severity. The largest transit systems suffer from common violations of local ordinances, very frequent larcenies, and frequent robberies and simple assaults. Aggravated assaults occur occasionally and rape and murder are very infrequent incidents. Medium and small transit systems, while also experiencing these crimes, do so at a lesser rate. Small systems, for example, have only very infrequent incidences of larceny, assault and robbery, and murder and rape are rare.

The crime information gathered from the site visits supports this generalization. Transit systems located in smaller cities with relatively low levels of serious crime suffer the least from mass transit crime. BAT services the city of Brockton, Massachusetts and the surrounding area, a population of approximately 130,000. While authorities at BAT state that passenger security is their primary security priority, BAT representatives could remember nothing more serious than two or three purse snatchings that occurred on the system during the past few years.

The situation is similar in Providence, Rhode Island and Springfield, Massachusetts. RIPTA, operating from Providence, a city of 157,000 people, and serving most of the state, reported that violations against passenger security are rare. STM, operators of a bus system in Springfield, a city of 152,000 in central Massachusetts, also reported that passenger security is not a problem. In 1980 RIPTA recorded only 11 larcenies and no burglaries. In the same year, STM reported three robberies and no larcenies.[9]

Conversely, the transit systems contacted for this study that are located in densely populated major cities with serious crime problems suffer the most from transit crime. Two notable examples are NYCTA, servicing New York City, and SCRTD, providing mass transportation for metropolitan Los Angeles. According to the FBI, these two cities hold the highest crime index totals in the country;[10] correspondingly they suffer from major crime problems on their transit systems.

In New York, fear for one's personal security keeps potential users away from public transportation. As concluded by the New York State Senate Committee on Transportation:

"Many people are afraid to ride the New York City transit system. Periodic reports of violent crime in the subway, ranging from outright murder to jostling of passengers by feral juveniles, combined with a threatening physical environment in which it often seems that civilization has taken its leave, make the average law abiding citizen hesitant to enter the system unless there is no other alternative. On the subway, the impression is given that even the most basic requirement of government, the protection of life and property is not being fulfilled adequately."[11]

While the tone of this statement and the perceptions of potential riders may exaggerate the severity of the problem, NYCTA does suffer from a serious personal crime problem. This problem is particularly severe on the subway, which carries over three and one-half million passengers each working day. Each year ten to twenty murders are committed in the system and approximately thirty rapes are attempted. Robberies reached 6,698 in 1982.[12] Minor larcenies, such as necklace, purse and wallet snatchings, are pervasive numbering almost 8500 in 1980.[13] Necklace snatchings, a seasonal phenomenon, range from zero per week in the winter to 300 per week during the summer months. Finally, violations of NYCTA ordinances such as smoking, eating or playing radios on transit vehicles are commonplace. In 1982, NYCTA transit police issued 80,000 summonses for smoking on transit vehicles.

Security personnel at SCRTD report that their primary security priority is the protection of operators and passengers from violent crime. Los Angeles is a large urban area with a serious crime problem that is reflected by the criminal activity occurring on the city's buses. Assault is a serious problem on both the streets and buses of Los Angeles. On a more positive note, SCRTD officials were proud to note that violent crime on the buses had been decreasing relative to violent crime in the streets.

At MUNI authorities indicated the one of their major security problems is assaults and robberies on buses, especially on routes that pass through high crime areas. In Oakland, representatives of AC Transit report concern over an increase in assaults on passengers, especially in the inner city areas of Oakland, Berkeley and Richmond. In Chicago, another city with a major crime problem, CTA reported 2,652 larcenies and 521 robberies in 1980. CTA recorded an increase in Part I offenses from 2,208 in 1977 to 3,268 in 1980, an increase of almost 50 percent.[14]

As noted above, transit systems suffer from unique mixes of transit crimes. Certain systems, such as BART, the WMATA rail division, and NJT-Rail operate primarily as commuter carriers bringing workers from the suburbs, where personal crimes occur much less frequently, into the inner city. The nature of crime differs in these commuter lines from the more traditional inner city systems; the most notable difference being the lack of serious crime against passengers. At all three systems, authorities reported that assaults and robberies against passengers were not major security problems. Representatives at BART and WMATA indicated that the protection of property at its parking lots was a major security priority. At BART, the most common serious offense committed is auto theft and burglary. The system has become a very popular method for commuting to work in the San Francisco Bay area. At the outer limits of its service area, BART has provided huge parking lots in order to attract commuters to the system; these parking lots have proved to be the source of BART's major security problem. In 1982, 1,432 cars were burglarized and 527 were stolen from BART parking lots. The majority of parking lot crimes are against property, not persons. Parking lot personal crimes at BART tend to be purse snatchings and minor sex offenses. BART reported little criminal activity against passengers in stations or on trains.

The crime situation at WMATA is similar to that at BART; one of the major security problems is parking lot crime. The primary security responsibility for WMATA parking lots is held by the local authorities, however, recent high rates of crime in the parking lots have resulted in increased surveillance by WMATA police. Personal crime is not a problem at either of these systems. This may be due not only to the effectiveness of the security operations but also to aspects of the systems that are characteristic of the more recently constructed commuter oriented carriers. Such characteristics might include the nature of the patrons served, the location of the routes, the fact that these systems reduce or end operations following the commuter rush hours, and the fact that they are newer systems designed and operated with security in mind.

The financial costs of passenger security violations can include both increased operating costs and reduced revenues. As crimes against transit passengers occur, the system may be compelled to upgrade its security efforts by increasing the labor hours of transit police and/or installing additional security related equipment. These expenditures for additional labor and new equipment represent added operating costs for the system.

If the system chooses not to respond with an upgraded security effort, it risks a potential loss of ridership and revenues. A survey performed by Dunlap and Associates[15] verified that people do consider personal security when deciding whether to use public transportation. Non-users of mass transit frequently cite a lack of security as a major factor in their decision not to use public transportation. Given the current negative impression concerning mass transit security held by many riders and non-riders, the number of potential patrons discouraged from utilizing public transportation because of feelings of insecurity may be significant.

Officials of some transit systems claim that public perception of mass transit crime often exaggerates the situation. They blame, in part, press coverage of dramatic, albeit rare, events that tends to give the public false impressions concerning the security of mass transit. Spokespersons at NYCTA claim that people will greatly overestimate the number of murders that occur on the system each year. While NYCTA reports ten to twenty murders per year, people often have the incorrect impression that this number exceeds 100.

Regardless of the accuracy of perceptions, they do influence potential passenger behavior causing people to choose not to use mass transit. For the transit system this results in a loss of revenues. It is unclear how many people avoid mass transit because of feelings of insecurity, nor is it known how much revenue is lost. Nevertheless, it is known that improving the public's perception of security on a system will attract more riders to the system.

3.2 EMPLOYEE SECURITY PROBLEMS

Like transit passengers, transit employees, especially bus drivers and token sellers, are potential victims of transit crime. Bus drivers, being highly visible and vulnerable, are easy targets for unruly passengers, and token sellers with sizable amounts of visible cash are attractive targets for would be thieves. Transit employees are potential victims of a variety of crimes including murder, rape, assault, and robbery, as well as acts of vandalism such as missiling (the throwing of an object at a moving vehicle) and turning switches. Most serious crimes such as murder, rape, and robbery occur infrequently. Acts of assault and vandalism are much more frequent and can result in serious harm or even death for bus and train operators.

Prior to the introduction of exact fare systems, the cash that bus drivers carried was an invitation to driver assault. Robbery of bus drivers reached epidemic proportions during the 1960's. From 1963 to 1968 the nation's bus systems experienced a fivefold increase in bus driver robberies and a tenfold increase in driver deaths.[16] In Washington, DC during one month in 1968, one driver was shot during a robbery and another was murdered in a robbery attempt. The immediate response to these events in Washington, DC was to enact an exact fare procedure which was effective in sharply reducing robbery attempts. Under pressure from the Amalgamated Transit Union, the exact fare procedure was quickly adopted by many bus systems around the country, and a major cause of attacks on drivers was eliminated.[17]

Unfortunately, eliminating robbery as a motive did not permanently cure the problem of assaults on drivers. Recent studies and our contacts with transit systems confirm that driver assault is still a significant problem.

Where robbery is not the motive, driver assaults seem to be triggered by certain events. Passengers attempting to avoid paying their fare may assault the bus driver if challenged. Drivers attempting to quiet rowdy youths or drunk and disorderly adults may be attacked. It is generally conceded that assertive behavior on the part of drivers often contributes to driver assaults in these situations. However, many assaults are entirely unprovoked and unexpected. Such attacks are the most difficult to protect against.

Seattle, Pittsburgh, and Los Angeles are among the major cities that have experienced problems with driver assaults in recent years. In Seattle, the bus system was reporting a high number of operator assaults, in part due to their unique fare structure in which passengers may ride for free within the central business district (CBD). With such a fare structure, passengers who enter the bus inside the CBD and exit elsewhere have received transport before payment is expected. Fare evasion upon exiting the bus became commonplace and operators who challenged the evaders were subject to assults.[18]

In the mid-1970's, PAT experienced an increase in operator assaults reaching 80 such attacks in 1977.[19] In Los Angeles, the number of assaults on bus operators peaked in 1980 with 225.[20] Subsequently, driver assaults have declined on these three systems due to the implementation of a variety of security measures. (See Section 4.0.)

Assault on bus drivers is not confined to large urban systems. Conversations with officials at RIPTA, a relatively small system, indicated that although assaults were not a major problem, they do occur. In 1982, a driver was seriously beaten and missed three months of work. Assaults on RIPTA generally occur at the end of a line and during evening hours. Usually, robbery is not the motive. The assault problem has been serious enough to warrant passage of a state law making driver assault a felony in Rhode Island.

Transit employees who sell tokens and make change also are vulnerable. Situated by themselves, away from other transit personnel, they are easy targets for crime. At NYCTA, robbery of change booths is a serious problem. Change booths are protected by bullet-resistant glass and equipped with radios, but robbers sometimes threaten to ignite gasoline fires in the booth. In some cases these threats have been carried out. Such acts are rare nationwide but provide a major security threat at large urban subway systems.

Vandalism perpetrated against the transit system may intentionally or unintentionally result in physical harm to transit operators. At BART, "missiling" is a problem; during the summer five to ten missiling incidents can occur each week. Hard objects colliding with a windshield can cause serious harm to the vehicle operator. At NJT-Rail, juvenile vandalism is their major security problem. Most incidents involve missiling but recently a track switch was tampered with resulting in the derailment of a train and the death of an engineer.

Violations of transit employee security impose various pressures on transit systems that increase the costs of operating the system. These costs include the loss of time as a result of an injury to an employee, increased medical and hospitalization costs, and higher insurance premiums. In addition, low employee morale, poor management/labor relations and high employee turnover rates represent indirect costs which may also have an impact on the operating costs of the system.

In sum, transit employees, particularly vehicle operators and booth attendants, are vulnerable to a wide range of crimes. Some generally less serious crimes, such as assault and vandalism, may on occasion escalate to the point where an employee is seriously harmed or even killed. The risk of such escalation is one of the problems associated with allowing some crime to exist on the transit system.

3.3 REVENUE SECURITY

Transit crimes related to revenues include fare evasion and fare theft. Fare evasion occurs when a passenger avoids paying all or part of the fare. Fare theft involves both robbery and burglary committed by persons outside the system or internal theft by employees. Fare evasion and fare theft are reported as major security problems at many transit systems.

A key factor contributing to the magnitude of both problems is a general increase in fare levels nationwide that has made the use of dollar bills more common on mass transit systems. This increased use of dollar bills has created handling, verification and accounting problems for transit systems that have made them more vulnerable to fare evasion and fare theft.[21]

3.3.1 Fare Evasion

Fare evasion in mass transit takes a variety of forms. Passengers may attempt either to board vehicles by paying a partial fare or to avoid fare payment procedures altogether. They also may use existing fare media in a fraudulent way, or use counterfeit fare media.

3.3.1.1 Shortchanging - "Shorting the box" is a common method of fare evasion. In this case the passenger deposits a collection of coins into the farebox that amounts to something less than the full fare. If the driver is unable or unwilling to verify the amount deposited, the passenger rides at a discount. There is little risk for the fare evader. If challenged, the shortchanger simply pretends to have erred and deposits the balance of the fare. This problem has been exacerbated by the trend toward higher fares. The resultant increase in coinage makes it more difficult for the driver to verify that the correct fare has been deposited.

3.3.1.2 Fare Payment Avoidance - All transit systems have specific payment procedures to be followed by passengers. These payment procedures include activities such as depositing cash into a farebox, using a token to pass through a turnstile, displaying a pass or transfer, or feeding a ticket into a machine upon entering and exiting the system. The transit systems contacted reported a variety of ways that such payment procedures are avoided by patrons.

Payment procedures typically require passage through some barrier, either physical or human. The fare evader searches for opportunities to avoid or surmount this barrier. On a bus, with the operator monitoring the payment of fares, fare evaders use avoidance techniques such as entering the vehicle through the rear door or boarding with a large group hoping to avoid detection. Others boldly refuse to pay the fare. In many circumstances, the operator, intimidated by the situation, will allow the fare evasion to occur rather than cause a confrontation or risk an assault.

At rail systems, common avoidance techniques include stepping through a turnstile with another person, pushing back or jumping over the turnstile, or passing through the special access gate. Token booth operators may often view such evasions, but are generally not in a position to stop them.

3.3.1.3 Misuse of Fare Media - Mass transit systems allow a variety of fare media to be used for fare payment. In addition to cash, fare media include tokens, tickets, transfers and passes. Deliberate misuse or falsification of fare media is a common form of fare evasion.

Transit systems often sell passes at a substantial discount to youths, students, the elderly and the handicapped. Unauthorized persons attempt to use these passes to gain entrance to the system at a reduced rate. For example, at one transit system contacted, the various types of passes are printed in different colors to facilitate quick identification. Regular fare riders attempt to use discounted passes by altering the color of the pass or handling the pass in such a manner that the color is not easily identified. During the rush hour, it is impractical for transit employees to carefully inspect each pass. At another system, student passes are sold at a significant discount (20 percent of the regular monthly pass). Since proof of student status is required only at the time that the pass is purchased, nonstudents easily board transit vehicles with these reduced rate passes.

Transit systems that utilize automatic fare collection (AFC) systems and magnetic strip tickets are vulnerable to fare media misuse. Various methods of manipulating the system were discovered at the systems contacted. One such method is the "two ticket scam". Given that the fares on these systems are based upon trip length, regular users can carry a set of fare tickets from various points throughout the system to "shorten" the ride and reduce the fare. Some

systems have an override that will invalidate a ticket upon egress from the system if the ticket has not been used within a reasonable length of time. Such a system would eliminate the "two ticket scam," but many station supervisors disconnect the override during periods of congestion to facilitate egress from the station.

AFC ticket vending machines have not proven to be tamperproof. Transit police at one system discovered that by utilizing a coin connected to a string, a fare evader can purchase a fare ticket worth dollars by repeatedly depositing and withdrawing the same coin. In addition, magnetic fare tickets are vulnerable to manipulation. Transit users with access to the proper equipment can and do alter the value of their magnetic fare cards. Other fare evaders have invented a variety of methods to defraud the system by manipulating these cards. For example, magnetic fare tickets can be easily demagnetized. The transit system will usually refund the remaining value of the ticket in this situation on the assumption that the demagnetization was accidental. One patron was covering with tape the area on the ticket where fare information was printed out. After using the full value of the ticket, he removed the cover, demagnetized the strip, and submitted the ticket for a refund. Since there was no printed record of use, he received a refund for the full value of the ticket.

Other methods of fare media misuse include the unauthorized use of special tokens, the improper use of passes issued to employees and their dependents, and the misuse of transfers. Youths on buses will often pass transfers through windows in the rear of the bus to waiting friends who will then board the bus at no charge. Transfers also are stolen from buses and then are either used to gain access to vehicles or are sold or distributed to friends by the perpetrators.

A type of fare media misuse which recently has become more common involves half-dollar bills. Some bus riders will deposit one-half of a dollar bill in folded condition into a farebox, using the other half the next time they ride. It is virtually impossible with most fareboxes for an operator to detect and successfully challenge such a ploy, since once deposited, the bill cannot be retrieved by passenger or operator. As fares increase and the use of dollar bills becomes more common, the half-dollar bill problem becomes more severe. At bus systems where dollar bills are accepted or not seriously discouraged, the

half-dollar bill is becoming commonplace. At one system contacted, an average of 1,000 half-dollar bills are collected each day. At another system, no records are maintained, but piles of half-dollar bills numbering in the thousands were observed in the counting room. Most transit systems receive only fifty cents for two unmatched halves of a one dollar bill, although some banks will refund the full value. This discounted amount and the cost of labor required to handle the bills results in significant revenue loss for some systems.

3.3.1.4 Counterfeiting of Fare Media - Counterfeiting of fare media is another form of fare evasion. Fare media subject to counterfeit include currency, passes, tickets, transfers and tokens. The counterfeiting of transit passes ranges in sophistication from simple photocopying to careful reprinting. Monthly or yearly passes often inspire careful and expensive counterfeiting efforts. On the other hand, juveniles will attempt and often succeed with crude attempts at counterfeiting. In most cases, the state-of-the-art is such that vigilant transit employees can detect most counterfeits.

Other forms of counterfeit media that appear on transit revenues include slugs, forged tickets or transfers, foreign coins, or tokens minted for other purposes. Some of these illegal fare media are forgeries, deliberately designed to defraud the system, such as slugs minted to resemble transit tokens or forged tickets. Others resemble system fare media by coincidence. Foreign coins, sometimes worth only a few cents, can often be successfully substituted for a transit token. Tokens minted for other purposes or other systems also may sometimes be substituted. In a recent example, the Connecticut Turnpike Authority minted a set of tokens that inadvertently allowed access to the NYCTA subway system. New Yorkers quickly began using these cheaper, readily available substitutes in lieu of the more expensive NYCTA tokens.

3.3.1.5 Extent of Fare Evasion - Virtually every transit system suffers from some form of fare evasion. Some systems report that while fare evasion exists, it is not a major problem, occurring only sporadically and infrequently. Others cite fare evasion as one of their major security problems. As one transit police captain reported: fare evasion is a good risk, because even if the habitual evader is apprehended and cited once every three weeks, regular fare evasion remains profitable. Fare evasion is not an offense that is vigorously pursued by the courts.

Estimates as to the frequency of fare evasion are incomplete and vary widely. Some systems estimate an evasion rate of less than one percent of revenues, others guess that the rate may be as high as ten percent. BART cites fare evasion as one of its major security problems. Out of an average 450 arrests per month, 345 are for fare evasion. The MBTA reports a loss of up to $400,000 a year due to fare evasion. A 1975 study at the NYCTA estimated a fare evasion rate of four percent systemwide, seven percent at some stations, and a rate as high as 14 percent at one particular station.[22] Currently NYCTA's revenue loss from fare evasion is estimated at $30-$40 million a year.[23] MUNI estimates a loss of 12 percent of revenue through fare evasion, but some MUNI bus drivers believe the correct figure is 25 percent.[24]

3.3.2 External Fare Theft

In addition to fare evasion, transit systems lose revenues to theft. External theft of fare revenues on transit systems (i.e. robberies and burglaries) typically occurs at various cash-holding points, such as automatic fare collection (AFC) machines, token booths, and vehicles that transport the cash to the counting room.

New systems such as BART and WMATA have experienced significant losses of revenue from burglaries of their AFC machines. At BART, theft from ticket machines is considered a primary security problem. Until recently, AFC machine theft was also a primary problem at WMATA. Over a two-year period, the system lost an estimated $128,000 due to such burglaries.[25] In the month of June, 1981, the number of monthly AFC machine assaults at WMATA peaked at 22. Since that time a vigorous prevention program has reduced the number of burglaries and none have occurred during a recent three month period.

Token booth robbery is a transit crime confined to the stations of large urban rail systems. Development and installation of new technology and equipment have reduced the vulnerability of token booths. Despite these security measures, token booth robberies still occur. The presence of bullet-resistant glass provides some security to the token seller, but robbers have invented new forms of intimidation. At NYCTA, robbers threaten to ignite token booths with gasoline unless money is handed over. In some cases, these threats have been carried out.

Most transit systems transfer cash to the counting room using their own vehicles and employees. The types of vehicles and employees utilized varies

markedly. There is also wide variation in the kinds and extent of security precautions taken.

The frequency of vehicle robberies is difficult to determine. Such incidents do occur; however, transit systems often are reluctant to publicize them for fear of stimulating further robberies. Consequently the overall frequency remains unknown.

External theft of fares is not restricted to the cash holding points discussed above. Occasional robberies and burglaries occur at other holding points in the system. There have been problems with thieves burglarizing the fareboxes of buses parked in transit yards. In a few cases cash has disappeared from counting rooms, and the thieves have never been identified. Given the more than adequate external security of many counting rooms, it is probable that most of these thefts were perpetrated or assisted by employees. However, lax security at some systems allows for the possibility of external counting room thefts. At one system cash is counted in an open area inside the garage and adjacent to the door giving access to the yard. There is no access control to either the transit yard or the garage leaving this counting room vulnerable to robbery. Finally, despite locked fareboxes and exact fare procedures, robberies of bus drivers occasionally still occur. In such cases, little cash may be involved, but the attempted robbery often places the operator in a dangerous situation.

3.3.3 Employee Fare Theft

In reference to theft of transit revenues by employees, the APTA Transit Security Guidelines Manual warns:

> "Representatives of transit systems using any of the manufacturers' fare collecting equipment agree that given sufficient time and inclination, some employees will attempt to steal from the fare collection revenues. The revenues and the temptation are so great that constant management and supervisory attention are necessary to discourage all levels of employees from attempting to compromise the system."[26]

Employee theft of revenues is considered to be a major security problem at many transit systems. Other systems, while not claiming to have such a problem, have weaknesses in their revenue collection, handling and accountability procedures that suggest the potential for, if not the probability of, employee revenue theft. In most cases, systems without methods for counting revenues as

they enter into the system, such as the use of registering fareboxes, have no means to measure whether employee theft is occurring. They have no incoming figures to match with bank deposit totals and may be unaware of significant employee theft problems.

The dollar bill problem complicates the situation. Many systems are ill equipped to collect, handle and account for dollar bills. In these systems, a great deal of trust is placed in transit employees. Some employees have been caught stealing, and it is likely that other thefts go undetected.

The revenue process is composed of a number of cash handling steps, and at any one of these steps, employee theft can occur. Very generally, these four cash handling steps can be defined as follows:*

- collecting cash from passengers
- temporary holding of cash on a bus or at a rail station
- transferring cash from that temporary holding area to intermediate points and/or the counting room
- counting the cash.

Systems differ as to which step they are most vulnerable, and few systems are secure at all four steps.

3.3.3.1 Cash Collection - The revenue handling process begins when the passenger exchanges cash for either entrance to a vehicle or a form of fare medium. In this exchange, before the cash is placed into a temporary holding place, there is potential for employee theft. Compared to the other cash handling steps, this step is relatively secure. Nevertheless, employee theft does occur, especially in situations where dollar bills are involved.

Most opportunities for employee fare theft during the cash collection step occur on bus systems. The newer rail systems utilize AFC machines removing any cause for employees to collect cash. On rare occasions, when the AFC machines fail or congestion from special events makes the use of the machines impractical, transit employees are used to collect cash directly from the passengers. Since

*A fifth step, transfer of cash to the bank, is typically handled by a private contractor with an armored truck and is not discussed here.

no records are kept of the number of passengers entering the system, the opportunities and temptations for employee theft of revenues in these unusual situations are great.

On rail systems where patrons purchase tokens for deposit in turnstiles, opportunities for skimming exist on the part of token sellers. Careful accounting of cash and tokens generally prohibits large scale theft, but since small discrepancies are tolerated, low level skimming may go undetected. Although probably an exaggeration, an official at one rail system complained that a standard exists among token sellers whereby approximately $5.00 per day may be skimmed from the token receipts as "coffee money." In addition, employees find ingenious ways to circumvent the accounting system, as indicated by the following instance, related at a system visited. A registering farebox attached to the collector's booth accepts fares from patrons using the special access gate. Fares fall through directly into the collector's booth. Recently it was discovered that the collector had been selling a filed down token, which when desposited into the special access farebox registered as a penny. This token was presumably recycled numerous times, netting the collector a profit with each deposit.

Bus systems provide a variety of opportunities for skimming during the cash collection step. The simplest method is for the operator to intercept cash from boarding passengers before they deposit it into the farebox. In some cases, drivers are allowed to handle cash. At one system visited, buses are equipped with fareboxes that do not accept dollar bills or fifty cent pieces. These fares are handed to the operator, who places the cash into an envelope which is then deposited in the side of the farebox. While not considered a major problem, driver skimming incidents do occur at this system.

At another system, where drivers also are handed bills for deposit, currency represents a decided temptation due to the volume of bills involved. On crowded vehicles, bills are collected faster than the driver can process them. As the bills accumulate, opportunities appear for operators to surreptitiously pocket the bills. Recently, one driver was caught stealing bills. Following this apprehension, the average weekly revenue in bills rose from $4,000 to $6,000, as other drivers apparently became more cautious.

3.3.3.2 Temporary Cash Holding - In theory, once fares have been collected in a farebox or other fare collection device, they are more secure. Nonetheless, there are a variety of ways that skimming can occur at these cash handling points. Malfunctioning fareboxes provide opportunities for operator skimming. When a farebox jams, the cash usually remains in the upper section of the box and is not registered. Most systems require operators to immediately report to central control when a jam occurs. If cash is allowed to accumulate in a malfunctioning farebox, it eventually becomes possible to reach into the box and remove the money. Therefore, it is easy for an operator to skim unregistered funds from a jammed farebox without detection simply by delaying the report of the malfunction.

Jammed fareboxes also present an opportunity for skimming by maintenance workers during the repair process. A number of systems expressed concerns about this type of skimming. At one system visited, two maintenance workers were fired recently after confessing to skimming revenue over a 7-month period.

Jammed fareboxes are not an uncommon occurrence. The NYCTA had 20,000 jammed boxes last year from which $10 million in unregistered funds was collected. On a typical day at the MBTA, 70 fareboxes will malfunction. This rate translates into over 20,000 jams a year. The increased use of dollar bills has contributed to an increase in the frequency of jammed fareboxes. Many fareboxes currently in use were not designed to accept dollar bills and often jam when bills are deposited. Finally, malfunctions are not always accidental. Drivers or maintenance workers may deliberately cause a farebox to malfunction in order to have access to the fares.

Special fareboxes designed to hold only dollar bills are particularly vulnerable. Many of these boxes are of simple design, do not register the amount deposited, and are easily violated. For example, one transit system, which usually will not accept dollar bills, has designed a dollar bill box for use on special routes where fares greater than $1.00 are collected. This speical farebox is clamped onto the side of the standard farebox. At the end of the run the dollar bill boxes are transported to the counting area where they are emptied. Bus drivers have discovered that these boxes can be forced open with a knife blade. Pictures of a number of these boxes were viewed, and each box was scarred with many knife scratch marks.

Some rail systems utilizing AFC machines have discovered serious problems with employee theft. The AFC machines at these systems are unreliable and require frequent maintenance from station agents and machine maintenance workers. In addition, the machines are not tamperproof. This combination of factors has created a situation where a variety of people have frequent access to a cash holding machine that can be easily manipulated to release its contents. Since a number of individuals do have access to the machines, it is difficult to both identify and implicate the thief.

3.3.3.3 Cash Transfer - The next step in the revenue handling process is to remove cash from its temporary holding device and to transport it to the counting room. Employee theft of revenues can occur during this operation.

The treasurer of one major bus system believes that his system suffers significant revenue losses during the "vault-pulling" operation (i.e. the removal of full vaults from bus fareboxes at the garage). Theoretically, a vault will automatically lock upon removal from the base of the farebox. However, the vault pullers at this system have devised a variety of ways to keep this from occurring, thus allowing easy access to the cash in the vault. Since the fareboxes are nonregistering and no other transit personnel are present during the vault-pulling operation, the temptation to steal is great. Last year six vault pullers were apprehended and prosecuted for stealing revenues. One vault puller was caught with $800 in system revenues. The total amount stolen cannot be computed, nor can the presence of systematic theft be verified, because the fareboxes do not register incoming funds and the system has no guidelines for anticipated revenues. Site visits revealed that vault pullers often work alone, hence the potential for such skimming exists at many bus systems. The use of a vacuum system to extract revenue from bus fareboxes avoids these problems, but there are other ways in which skimming may occur with vacuum systems.

At one bus system visited, lax security provides an opportunity for theft. Each night a cash collector circulates from bus to bus removing the contents of each farebox, including coins and currency. The coins have been automatically registered by the farebox, but the bills have been manually counted by the bus operator. Collusion between the operator and the collector, or simple miscounting by the operator, would provide the collector with an opportunity to pocket bills without detection.

Skimming of tokens from turnstile vaults was reported as a problem at one rail system. Officials at this system believe that station agents have access to vault keys and are removing tokens during the vault-pulling process. Another ploy is to remove the vaults, but not replace them until a number of tokens have accumulated inside the turnstile base. These tokens are then pocketed by the agent and an empty vault is placed into the turnstile.

Cash can also be stolen by employees while it is being transported to the counting room. At one system, shortages of as much as $800 per day were being discovered. Eventually, an armored truck driver was discovered to have access to a cash bag key. The driver was removing cash from the bags and hiding it in the sleeves of his jacket. The system estimated that the driver had stolen $60,000.

Another large system discovered that they were consistently short by thousands of dollars per day. After management closely investigated employees who transport the cash and found no wrongdoing, they focused on counting room personnel. They discovered that employees with access to vault keys were arriving to work early, opening vaults and skimming revenues.

3.3.3.4 Cash Counting - During the cash counting process, employees have direct contact with large amounts of money. Security procedures vary greatly among transit system counting rooms, and some are much more vulnerable to employee theft than others. At some smaller transit systems, counting room security is based primarily on trust. Counters, who may work in pairs or by themselves, tend to be veteran employees of the system who have earned the trust of management. Nevertheless, they can work with large sums of often unregistered funds and may feel the temptation to steal. None of the small systems contacted reported having a problem with counting room theft, but given the problems with revenue accountability at these systems, counting room theft easily could pass undetected.

At larger counting rooms, despite greater security efforts in terms of supervisory personnel and surveillance equipment, opportunities for revenue theft exist. Revenue from bus operations is sometimes unregistered, making it extremely difficult to detect losses. Even when registering fareboxes are used, totals are often aggregated at a high level, making exact counts difficult. Revenue from rail operations is frequently counted by individual collector's

booth or fare collection machine, but even here some discrepancies are tolerated, providing the opportunity for low level skimming.

At several large transit systems visited, counting room theft was considered a significant problem by system officials. At one system, despite the fact that the counting room is equipped with much new security equipment, an official in the transit police department believes that routine counting room theft occurs. At another system, treasury officials suspect that the counting room is a source of major revenue losses. A visit to this counting room revealed a facility equipped with many technical security devices but managed in an inefficient manner. Little order or discipline was evident in the facility. Coins and currency were handled carelessly and appeared lying haphazardly throughout the area, on chairs, tables, machines and the floor. This system has had several counting room employees prosecuted for revenue theft.

3.3.4 Bank Security Problems

After transit revenues are processed through the counting room, they are transported to the bank for deposit. There have been cases where bank employees have been found skimming transit revenues. In one case a $1000 discrepancy was discovered between the transit system and bank count of revenues. Following an investigation, the bank absorbed the loss.

A security representative at another system warned that care should be taken in reconciling deposit amounts with the banks. The representative indicated that banks have been known to use large deposits as a method of balancing their books at the close of business each day by transferring funds from the large deposits to cover shortages caused by their own employees' errors. For the transit system that is not careful this results in a drain on system revenues.

3.3.5 The Costs of Revenue Theft

The frequency and costs of revenue theft are difficult to measure, however most transit systems do suffer from some form of such theft: the occasional minor skimming by an employee, the infrequent robbery or burglary, or the systematic and substantial theft of revenues by employees entrusted with cash handling responsibilities.

Internal theft is cited by a number of systems as one of their major security problems. Others, suffering from more severe security problems such as operator and passenger assaults, relegate fare theft to a secondary security status. Still others overlook their fare theft problems altogether. In that most systems are not entirely secure from internal theft and given the huge amounts of cash that can be processed by transit systems, the potential for large internal losses at all these systems is strong. Since few systems have accounting procedures and fare handling equipment capable of accurately measuring the passage of revenues through the cash processing operation, the magnitude of internal theft suffered by these systems is probably underestimated.

External theft of transit revenues is equally difficult to measure. Transit systems tend to be reluctant to share figures illustrative of the extent of this problem, and media reports, while often dramatic when they appear, do not comprehensively cover the topic. External robberies and burglaries of transit revenues are not uncommon events, but further study is necessary to accurately determine the magnitude of this security problem.

3.4 SECURITY PROBLEMS INVOLVING TRANSIT PROPERTY

Transit property requires protection from both vandalism and theft. While theft of transit property is perpetrated by individuals both inside and outside the system, vandalism is typically perpetrated by outsiders, most often by juveniles.

3.4.1 Vandalism of Transit Property

The three most common forms of transit vandalism are broken windows, damaged seats and graffiti. According to a survey of bus systems performed by APTA, broken windows are the nation's costliest form of bus vandalism. Broken windows typically account for 49 to 65 percent of a bus system's vandalism repair budget. APTA identified six systems that spend over $100,000 each year repairing broken windows as well as many others that spend more than $10,000 per year.[27] Second in total vandalism costs nationwide is the repair of damaged seats. The majority of seat vandalism cases are cuts, slashes or tears in vinyl or other seat coverings.

Another form of seat damage includes burns from cigarettes, matches or lighters. Damaged seats typically account for 20 to 60 percent of a bus system's vandalism repair budget.[28] Even at the smallest systems visited, at least one person works full-time repairing bus interiors.

The third most costly type of bus vandalism is graffiti, usually located in the vehicle interior. At most bus systems, graffiti is not a major problem, accounting for only a small portion of vandalism costs. However, a few notable and well publicized cases that do not follow this pattern are the bus systems in New York City and Philadelphia. In these two cities, bus graffiti is a more serious and costly problem.

Vandalism is perpetrated primarily by juveniles. One variable related to vandalism problems, particularly at small bus systems, is the transportation of school children. RIPTA which transports school children, complains of vandalism problems, while BAT which does not make school runs, does not have a major vandalism problem.

Graffiti is a serious problem for some rail systems. The outside of a subway car with its large open spaces provides a tempting canvas for graffiti artists. At the NYCTA, 79 percent of subway cars were scarred with graffiti while only 20 percent of the buses were marked.[29] Unfortunately, nationwide figures regarding the costs of graffiti and other forms of vandalism at rail systems are not available.

The priority given to vandalism as a security problem at a transit system depends on the nature and extent of other security problems. Transit systems in larger cities that suffer from more frequent crimes against passengers and operators often relegate vandalism to a secondary security position. Systems in smaller cities with few personal crime problems cite vandalism as one of their major security problems. At RIPTA, authorities identify vandalism as their primary security problem. RIPTA has few personal crime violations but does experience 15 to 20 damaged seats per week in addition to periodic outbreaks of graffiti.

Some transit systems try to stay ahead of vandalism problems by routinely repairing and cleaning vehicles and facilities as soon as damage or graffiti is reported. At a number of systems, both large and small, these efforts seem to be effective. For example, SDT vehicles do not show the effects of vandalism. At a

few systems, vandalism and graffiti have become epidemic and despite large expenditures of labor and capital, the problem persists.

In terms of costs, vandalism raises operating costs and may cause reductions in revenues. The costs of operating a transit system rise when damaged equipment and facilities must be repaired and cleaned. A 1973 APTA study estimated nationwide transit vandalism costs at approximately $10 million in 1971.[30] Twelve years later this figure must be significantly higher. It was recently estimated that NYCTA alone spends $5 million to $10 million each year to counter the effects of graffiti.[31]

Vandalism also may contribute to a decrease in ridership and revenues collected by the system. For users of mass transit, vandalism contributes to the negative impression conveyed by some urban transit systems. Transit vehicles scarred by graffiti and damaged by other acts of vandalism cannot help but give the impression that control of the system has been lost and it has become insecure. This impression may be sufficient to cause many potential riders to use alternative means of transportation resulting in a loss of revenues for the transit system.

3.4.2 Theft of Transit Property

Virtually all transit systems suffer from some theft of transit property by both outsiders and employees. It is difficult to estimate how much is lost to theft because recordkeeping often is inadequate and even with good recordkeeping, theft may still go undetected. One large urban system had 55 buses stolen during the past two years. Other systems report major security problems at their yards. These yards often are poorly protected, allowing outsiders easy access to equipment, parts and tools. In other cases employees are the source of the problem. Transit employees have easy access to parts and tools, and unions often object to transit management taking the security precautions necessary to prevent employee theft. The employee union at one transit system prevents management from inspecting employee cars as they exit the transit yard. At another system, authorities report that property theft is minimal, but each year an independent auditor suggests an around-the-clock parts person to control the flow of parts within the garage. Transit theft involves theft of all types of tools and parts, tool boxes, batteries, air compressors, spare parts and even fuel. Due to this

problem, the transit system must either absorb the loss from stolen equipment, devote more resources to the protection of transit equipment, or a combination of the two.

3.5 THE PROBLEM OF WHITE COLLAR CRIME

The problem of "white-collar" crime at transit systems is an area in which very little information was available. The problem is essentially the same as that encountered by other large public and private organizations. The issues involved include the control of funds and disbursements. To high level administrators, these are obviously very sensitive areas for discussion. Discussions with such administrators provided the impression that white-collar crime is virtually nonexistent at transit systems. Major purchases generally are publicly bid and minor acquisitions are carefully monitored. In addition, outside auditors regularly inspect the financial operations of the transit systems.

Discussions with security personnel gave a somewhat different impression. Security officials at one system stated that they are very concerned about the abuse present in the contracting for new construction. A security official at another system expressed his concern over the issuance of small contracts. While contracts worth greater than $10,000 are opened to public bid, smaller contracts are not controlled. This security official believes that the system overpays for these contracts.

Little can be concluded from the information gathered. It is likely that some white collar crime does occur, and the comments from security officials support this notion. However, further study is necessary to determine the extent of the problem.

4. TRANSIT SECURITY COUNTERMEASURES

Section 4 describes various programs pursued by transit systems to provide security for their passengers, employees, revenues and property. Within this section, Section 4.1 examines the concept of systems security by discussing the interrelatedness and multi-purpose aspects of different security programs. In Section 4.2 differences in transit security organization and policing activities are discussed. Section 4.3 identifies and describes the equipment and technology utilized by security personnel. Revenue security countermeasures are examined in Section 4.4. The remaining sections describe other security-related activities such as internal investigations, legal system relationships, and education and public relations programs.

The primary purpose of Section 4 is to describe programs and products utilized by the systems visited so that they might be considered for wider application. An important secondary purpose is to identify the particular transit systems utilizing specific programs and products so that parties interested in the value, cost, and difficulties with a given security measure can make inquiries directly to those experienced in their use.

Finally, it should be recalled that the main purpose of this report is to provide a survey or overview of current programs and products utilized in providing transit security. Although a certain amount of evaluation inevitably creeps into such a survey, methodical evaluations were not performed or intended.

4.1 A SYSTEMATIC APPROACH TO SECURITY

For any given transit security problem, there are a variety of solutions; and most solutions counter not just one, but a variety of transit security problems. There is no simple match between problem and solution. Thus, the key to achieving and maintaining effective transit security is to understand the total impact of possible solutions and to utilize the optimal mix of such solutions given both the extent and nature of security problems and the budget of the security department.

Consider the example of a subway station in which larcenies, robberies and assaults have become a problem. The security department has a variety of countermeasures to choose among, some of which will be more effective than others. Possible solutions to this problem include:

- Deploying a police officer inside the station to act as a visible security presence
- Installing surveillance technology such as CCTV, emergency telephones and silent alarms to expedite police response when an event occurs
- Increasing the amount of lighting in the station or eliminating dark passages, corners and other hiding places to effectively reduce the surprise element in an attack
- Implementing procedures for patrons to follow such as designated waiting zones in the station to encourage passengers to congregate, thus making an assault on an individual more difficult
- Closing the station entirely, either permanently, temporarily or at particular times during operating hours

Obviously, the selection of one or more countermeasures will depend on a variety of factors, including the severity and nature of the problem, the resources available to the security department, and the design and characteristics of the station. One important factor that may often be overlooked in this decision-making process is the secondary benefits (security and otherwise) that may be derived from each possible countermeasure. Deploying police at the station may not only relieve the assault problem, but also may reduce fare evasions, violations of local ordinances and other forms of anti-social behavior. In addition, the presence of a uniformed officer may increase perceived security at the station and encourage greater use of the facility. The installation of surveillance equipment, facilitating police response to assault situations, also may have an inhibiting effect on other forms of criminal behavior, both minor and more severe. Alternatively, eliminating or restricting the hours of use at individual stations may contribute to a perceived negative impression of transit security, thereby both contributing to a decline in ridership and encouraging additional criminal behavior.

Ideally, the selection of a solution should be made on the basis of its total impact on security at the transit system, not just its effect on an individual security problem. Decisions should be made from a systematic, long term perspective, not with only one immediate problem in mind. The total costs of implementing a solution and the total benefits to be accrued by the solution should be estimated for each potential countermeasure and then benefit-cost

methodology should be used to designate programs for implementation. Referring to the example, the best solution would be the countermeasure or combination of countermeasures that provides the largest amount of benefits, in terms of both the problem of assaults on patrons and systemwide security, relative to the costs of implementing the countermeasure.

Optimally, transit systems would regularly follow a systematic approach to security, and security problems, like the passenger assault situation in the example, never would occur. Realistically, systematic approaches are difficult to implement at transit systems that have been operating for years with limited budgets and in a traditional reactive manner. However, gradual efforts to bring a systematic approach to security planning would yield positive results in terms of a more secure transit system.

4.2 SECURITY PERSONNEL - ORGANIZATION AND ACTIVITIES

This section examines the different ways that various transit systems structure their security activities within the overall hierarchy of the system. It also describes the varied methods used by transit security departments to organize themselves and many of the various activities pursued by transit security personnel.

4.2.1 Structure and Organization

Transit systems vary widely in such characteristics as the number and type of passengers served, the amount and form of revenues handled, the size of the area serviced, the number of political jurisdictions crossed, and the nature, frequency and severity of security problems encountered. In response to these variables, transit systems differ in how they structure their security departments within the overall hierarchy of the system; they also vary the internal organizations of their individual security departments to be better able to respond to the particular characteristics of each system. Four general mass transit security structure and organization categories can be distinguished:

- Transit systems with their own in-house police forces
- Transit systems that rely on a special transit police unit supplied by the municipal police department

- Transit systems that contract their police work to a private security firm
- Transit systems that primarily rely on local police

4.2.1.1 In-House Security Organizations - Many major transit systems have in-house security organizations that operate much like city police forces. The sizes of the staffs vary with security needs and budgetary constraints. For example, the NJT-Rail police department has 40 officers. MBTA has 69 officers, SCRTD 70, BART 133, WMATA 217, and the NYCTA police force numbers 3200 members. These in-house security forces are led by a police chief and are composed of officers of various ranks. For example, the 133 police officers at BART include 1 chief, 2 captains, 4 lieutenants, 20 sergeants, and 106 officers. The chief of police typically reports to either the general manager or an assistant general manager. At NYCTA, the chief reports to both the general manager and the mayor.

In addition to police officers, some of these transit security departments also employ a variety of other workers including administrators, clerks, secretaries, radio dispatchers, revenue protection guards, patrol guards, truck drivers and service inspectors.

Some large transit system security departments are divided into functional bureaus. For example, at WMATA the security department is divided into three major bureaus. The Field Operations Bureau consists of the basic police patrol force. The Support Operations Bureau is responsible for overall revenue security, training, budgets and computer facilities; and the Security Operations Bureau provides guard support for yards, buildings, facilities and revenue trucks.

In most cases, all security responsibilities are handled by the transit police department, but there are a few examples in which private contractors are used as supplements. SCRTD and WMATA both use contractors to guard facilities.

Transit police officers are recruited by transit systems from the general population, police academies, other police forces, and other transit employees. NYCTA police recruits are hired from the same civil service register as city

police. SCRTD recruits its officers through distribution of flyers and word of mouth, and recently has made a successful effort to recruit more women. The MBTA police staff is composed of former municipal police officers and transit drivers.

Salaries for transit police vary widely. BART police officers receive $20,400 to $27,600 per year. This salary is not competitive with those offered by some other police departments in the San Francisco Bay area, and this discrepancy contributes to a ten percent turnover rate. SCRTD, which offers competitive wages, does not have a turnover problem. In addition, officials believe that many officers are remaining with the SCRTD police department in hope of receiving promotions when Metrorail begins operations. Police officers at WMATA receive a wage that is based on the average pay of the five highest paying police departments in the Washington DC area.

At most systems visited, transit police recruits are required to undergo psychological testing and background checks as a prerequisite of employment. Upon acceptance to the force, transit police officers typically receive training identical to that given to city police. They also receive special transit police training.

Many transit officers also receive periodic retraining. At BART, weekly training sessions are provided in areas such as arrest procedures, baton handling, hostage situations, crowd control, arms and other security matters. At WMATA police officers are required to attend one week of formal training every two years and must qualify with their weapons each year.

The police chiefs of these large transit police forces are typically highly qualified individuals with much experience in both municipal and transit police work.

4.2.1.2 Transit Systems With Local Police Special Transit Units - A few systems, including MUNI, CTA and SEPTA, have their security responsibilities performed by special transit units of the local police department. These systems are organized and operated much like the in-house transit police departments.

Although these special units provide policing activities, they may not be responsible for all security functions. For example, transit policing at MUNI is provided by a special transit unit of the San Francisco Police Department (SFPD)

that has responsibility for passenger and driver security and for enforcing the laws and ordinances of the system. Facility security and revenue security, however, are the responsibility of the San Francisco Public Utilities Commission (SFPUC)'s Protective Services and Investigation Bureau.

In Philadelphia and Chicago, special transit police units are used to protect the subways, and the buses are patrolled by regular municipal police officers. At these two systems, internal transit security forces are responsible for protecting transit facilities and property. The internal security force at SEPTA also is responsible for protecting revenue collection.[32]

Some systems use off-duty police officers as their security force. In St. Louis, the Bi-State Development Agency, a medium size bus system, employs a large number of local police officers on a part time basis. The system has no formal relationship with the local police department, and the local authorities have no special responsibility toward the transit agency. The off-duty police officers are deployed throughout the system to provide security.

4.2.1.3 Transit Systems With Contracted Police Services - Some transit systems, including AC Transit and SDTI, have elected to contract for their security services. In 1973, when local police proved inadequate to respond to transit security problems, AC Transit hired a private security firm to provide such services. This contract, still in effect, costs $1.5 million annually, for which AC Transit receives the use of 35 armed security guards during a 24-hour working day. These 35 people are selected from a pool of 85 to 90 who have passed a special transit security training program. Any individual from this pool may be dismissed by AC Transit at any time without cause.

The contracted security guards report to AC Transit's Chief of Security, the only in-house security person. The Security Coordinator is a certified police officer with 15 years of police experience. He reports directly to the Assistant General Manager of Operations.

When SDTI was in the planning phase, officials intended to use a ten person special police detail from the San Diego Police Department. This plan was later dismissed due to the high cost of the special detail, $800,000 per year.

Instead, a contract security service was employed. The contractor provides a professional appearing, uniformed and armed presence on the trolley system.

While the contracted security forces at SDTI do not have full police powers and may not make arrests or issue citations, the system does employ fare inspectors who are authorized to issue citations to fare evaders. SDTI is a barrier free system, in which passengers are expected to have purchased tickets before boarding the vehicles. Passengers riding without a valid ticket may receive a citation from an SDTI fare inspector.

4.2.1.4 Transit Systems That Rely on Local Police - Small transit systems typically do not have security forces and must rely on local authorities to provide the majority of their security services. There are few in-house personnel responsible for security, and these individuals often have other duties as well. For example, at RIPTA the principal security employee is the Chief of Safety, Security and Training. At BAT, the Director of Safety is responsible for security matters, and at STM, security responsibilities are shared by the Safety Officer and the Claims Officer. In some cases, these security officials have former police experience; in others they have held a variety of positions with the transit system before assuming the responsibility for security. They report directly to and typically have close working relationships with the general manager.

Other employees with security-related responsibilities are station supervisors, patrol guards and spotters (see Section 4.2.3). Bus systems typically have station supervisors or starters who oversee the operation and scheduling of the buses, provide assistance to passengers, and handle minor security violations. While typically not trained in security enforcement, these individuals can provide a uniformed presence that inhibits some anti-social behavior.

Security violations at small transit systems, except for minor disturbances, are handled by the local police. Usually, formal agreements regarding police activities on buses and at terminals are not arranged. Police officers simply respond to calls from the transit system as they would to any other call.

One exception to this rule is found at BAT. Officials at BAT, concerned about security at their major downtown terminal, arranged for the Brockton Police Department to provide a duty officer at the terminal during operation hours. The officer is a permanent detail from the police department at a cost of $40,000 per year to the transit system. BAT officials prefer to use a local police officer rather than a private security firm for a number of reasons. They feel that by entering into a formal agreement with the local authorities for which they provide financial support, they receive quicker response to their calls throughout the system. In addition, the agreement allows for flexibility and can be easily terminated.

4.2.2 Security Management Activities

Security management activities at transit system security departments generally are characterized by a set of formal standard operating procedures that cover most daily occurrences, informal relations with the local police departments and little, if any, long term security planning. There are exceptions, some of which will be discussed below. One area of security management that is currently undergoing a major change is the handling of crime statistics. Many transit systems are currently planning or implementing computerized management information systems (MIS) to better organize crime information which can then be used for a more efficient distribution of personnel.

Most transit security departments have some form of written standard operating procedures. BART and WMATA have detailed procedures manuals. BAT has written procedures for cash collection and handling that are designed to secure the system's revenues. At NYCTA, although the transit police have no long range security plan, standard procedures for handling certain emergency situations, such as bomb threats, are outlined in the Police Guidelines. NJT-Rail currently is developing a policy and procedures manual. As part of this process, they are studying manuals used by other transit systems. In situations not covered by the procedures manual, the course of action is left to the discretion of transit employees. Most transit security departments rely on specialized units of the local authorities, such as bomb squads or SWAT teams, in these situations.

Few of the transit security departments visited have long term security plans. Two exceptions are BART, which has both short and long term security plans, and AC Transit, which discusses security considerations in their extensive five-year plan. In lieu of security plans, transit security departments typically act in an ad hoc manner, responding to security problems as they occur.

Every transit system visited reported good working relationships with the local authorities. These relationships often are due to efforts made by the transit systems. Authorities at NJT-Rail report that they work at developing good rapport with local police departments. Officers on the road will visit local police stations to introduce themselves and explain the function of the NJT-Rail police department. Since its inception two years ago, the NJT-Rail police department has increased its respect and recognition considerably through these local police contacts.

The BART police department also was required to earn the respect of the municipal police. In California, the local police must agree to the granting of full police powers to a specialized unit like the BART police force. Approximately three years passed before the municipal police forces accepted the BART police as an equal. The BART police facilitated their acceptance by the local authorities by placing many officers who were formerly employed by municipal police forces in the area into upper echelon positions on the force. Currently, local police will readily respond to BART emergencies, and BART police reciprocate by assisting in local police emergencies.

Some transit systems maintain good relationships with local authorities through periodic visits and attempts to keep authorities informed of new developments. When green flashing emergency lights were installed on BAT buses, local police and fire departments were visited and given demonstrations of the new equipment.

Formal agreements with local authorities occur infrequently. One exception is SCRTD which has formal memos of understanding with the Los Angeles Police Department and the Los Angeles Sheriff's Department. The memos outline areas of cooperation and formalize the exchange of crime information. SCRTD hopes eventually to have similar agreements with all police jurisdictions in its service area.

Communication among transit security departments is common, especially among the larger departments. In the San Francisco Bay area, the Regional Transportation Authority (RTA) provides an opportunity for transit security departments in the region to regularly meet and discuss transit security issues. The APTA Transit Security Committee provides a regular forum for transit security officials to meet and discuss security matters (see Section 6.2.1). This group has well-attended quarterly meetings held throughout the country. These meetings are mainly attended by representatives of the larger systems whose budgets will allow for travel to such meetings a few times each year. In addition to formal gatherings, informal communication among security officials is common.

Security officials at smaller transit systems generally limit their contact to transit systems within their own local geographic area. Some security officials from small systems will attend APTA meetings that are located relatively nearby, but others do not attend such meetings. For example, BAT does not participate in APTA meetings, but has visited a number of transit systems to gain ideas for incorporating security considerations into plans for constructing a new garage facility.

One security management activity that is currently being pursued by many transit systems is the computerization of crime information. Most transit systems handle crime information manually, some more diligently than others due to the resources available. A few systems including MBTA and NYCTA currently have in-house computer capabilities that allow for analysis of crime statistics. These security departments utilize their crime data bases to determine where, when, and what type of crimes are committed enabling the chief to assign officers in a more effective manner. At MBTA, this system is believed to be partially responsible for a decrease of over 14 percent in Part I and Part II crime from 1981 to 1982.

Many transit security departments have access to national, state, county or local computerized criminal information systems. They use these systems to check a suspect's criminal history (see Section 4.3.12).

4.2.3 Policing Activities

Policing activities at transit systems are performed by a variety of employees including sworn police officers, security guards, patrol guards, supervisors and spotters.

4.2.3.1 Sworn Police Officers - Sworn police officers, whether they are members of a transit police department, a special transit unit of the local police, or a local police department, are the principal providers of transit security. The distinguishing characteristic of sworn officers is that they have full police powers, including arrest authority. Sworn officers act as patrol officers, undercover agents or detectives.

Patrol officers are used to provide a police presence and to respond to calls within the system. The extent of officer presence is determined primarily by crime levels and budgetary considerations. At WMATA, there is one patrol officer for every three stations, and each officer maintains a roving patrol among assigned stations. SCRTD, NJT-Rail and NYCTA concentrate their officers in high crime areas. Patrols are made on foot, by police car, on trains or on buses. Transit systems that operate both buses and trains generally concentrate their internal police efforts on train operations leaving bus security to the local police.

Transit police cannot patrol all parts of the system at all times. One way to deal with this limitation is the use of saturation patrols. At NYCTA, transit police periodically conduct "sweeps" of the entire transit system. During a "sweep", a station or area is saturated with police. Numerous arrests are made for all types of crimes including felonies, misdemeanors, and ordinance violations. In addition, turnstiles are adjusted to a stricter tolerance for easier detection of slugs and arrests are made for fare evasion. The program also addresses the problem of derelicts and vagrants who congregate on the system, creating an offensive situation for other passengers. As part of the sweep program, transit police and representatives of the city's Human Resources Administration approach these individuals. They are asked to leave the station, but are given the option of being transported to a shelter for the homeless.

Nine sweeps have been conducted to date. One sweep in 1982 netted 360 arrests in one day.[33] Although sweeps appear to be effective in lowering subway

crime, there is some evidence that crime in buses rises as a consequence, as criminals are discouraged from operating on the subway.

Sworn officers working in transit patrol situations usually dress like city police officers. In the early years of operation at BART, police officers wore blazers and concealed their weapons. This proved to be ineffective, and BART police now wear full military uniforms. In addition to wearing uniforms, transit police officers are armed and ride in marked patrol cars. They often carry batons, mace and two-way radios and sometimes wear bullet-resistant vests. They have full police powers and arrest authority.

Arrest procedures vary between transit systems. At SCRTD, transit arrests may be processed at any police station in the area. In the BART service area, transit arrests are handled only at specially designated police stations and a fee is charged for each arrest. The most complicated situation occurs at NJT-Rail. Following arrest, the suspect is taken to the appropriate municipality for booking. Under "2c" of the state code, the booking must occur in the municipality in which the suspect boarded the train. Under Title 48 of the Transit Crime Code, the place of boarding is irrelevant. Most judges are not familiar with Title 48. Therefore, most officers adhere to "2c" to prevent the case from being dismissed.

Most large transit security departments have sworn police officers who operate undercover in both external and internal situations. Plainclothes operations are emphasized at some transit systems because, as one security official stated, "No crimes occur in front of uniformed officers." Another transit security official called the use of undercover officers a psychological game because "you never know who is a cop." Undercover agents are used for a variety of purposes including apprehending fare evaders, patrolling parking lots, riding trains that are frequented by troublemakers and apprehending sex criminals. At WMATA, a significant decrease on bus driver assaults is attributed in part to the use of plainclothes police on buses.

4.2.3.2 Security Guards - Security guards are armed but they do not have full police powers. At some transit systems, where sworn police officers perform the primary security duties, security guards are used to protect revenues or property. For example, at BART, security guards are used to protect

system revenues. They accompany the vault pullers in the cash truck and escort car as money is collected from each BART station. They also protect the cash counting facility.

In other situations, security guards are used as the primary security force. At AC Transit and SDTI these guards act much like sworn police officers, but with a few major distinctions. Their purpose is to provide a security presence on the system and respond to security problems on the buses. They are deployed strategically throughout the system, patrolling in marked cars and responding to radio calls for assistance. While they are armed and wear a police-like uniform, they do not have police arrest authority; they cannot issue citations, but will hold violators with a citizen's arrest. They respond to specific and less severe problem situations on buses. In serious situations, the local police are called.

4.2.3.3 Patrol Guards - Patrol guards are unarmed guards who protect transit system vehicles, buildings, property and equipment. Their responsibilities are to act as a security presence and as an observer. If a problem situation develops, they are directed to call the police rather than become directly involved in the incident.

4.2.3.4 Supervisors - At small bus systems supervisors, also called starters, perform an important security function. These systems rely entirely on local police to provide security support. Supervisors, uniformed and carrying radios, provide a security presence at bus terminals. At RIPTA supervisors deal with minor disturbances on buses by asking unruly passengers to leave the bus. In more serious situations, they call the local police. In certain cases, RIPTA supervisors will operate undercover. Plainclothes supervisors ride buses on which graffiti is a problem and will hold offenders until the police arrive. RIPTA supervisors also inspect buses both before and after school runs for evidence of new graffiti.

MBTA is currently training its 320 starters and inspectors to perform basic security-related responsibilities such as detaining violators of less serious transit ordinances and settling arguments between passengers and operators. These trained employees will help to increase "security presence" on Boston's buses and trains.

4.2.3.5 Spotters - Spotters are used in transit security to observe transit employees at work. In most cases, the employee observed is a bus driver. The operators are watched for their manner of dealing with passengers, their ability to cope with problems, and their honesty. One use of spotters is to observe an operator who is suspected of skimming revenues.

The spotter may be a transit employee or a contracted agent. In some cases, police officers or security guards will be used as spotters; in others, the spotter may be an employee of the treasury department. More often than not, spotters must be contracted from the outside to avoid detection by the suspected party, especially at small systems where all employees are known to one another.

Some systems use spotters on a regular basis. The drivers generally are aware of this. Other systems only use spotters when there is cause for suspicion. When an operator is suspected of skimming revenues, a spotter is used only as an observer. A report by a spotter is not sufficient to prosecute. Following an incriminating report by a spotter, evidence still must be collected by the transit authorities or police.

4.3 PRODUCTS, EQUIPMENT, AND TECHNOLOGIES USED IN PROVIDING TRANSIT SECURITY

In providing for security the transit industry makes use of a variety of devices ranging from simple mechanical items such as fences to sophisticated electronic products such as computerized automatic vehicle monitoring (AVM) systems. Although the section begins with a number of large scale items and later discusses some smaller, less glamourous products, this is not to be interpreted as a hierarchy in terms of value or usefulness. Some of the latter items may have more practical value for enhancing transit security.

The list of items described is not exhaustive. Commonplace items such as door locks generally were ignored because their use is virtually automatic wherever they are needed and appropriate. Other items are undoubtedly left out simply because they are not commonly used and never were discussed or referenced in the preparation of this report. The authors would be pleased if readers of this report would bring such excluded items to their attention.

In this section references to manufacturers, brands or proprietary concepts are sometimes made. These references are not endorsements and should not be interpreted as a preference for a particular brand or make.

4.3.1 Closed Circuit Television

Closed circuit television (CCTV) is used in some form by many transit systems. There are, however, large differences in the nature and extent of its use, and some officials expressed reservations about its actual security value. CCTV applications fall into three general categories: (1) protection and observation of patrons; (2) protection of facilities; (3) the surveillance of employees in cash counting facilities. Regarding its use in the protection and observation of patrons, the most extensive use was observed at WMATA where every station has a set of cameras and its own monitoring booth. Thus each station agent is responsible for observing the entire station area and ensuring that patrons are not subjects or perpetrators of criminal activity. The low rates of personal crime and vandalism/graffiti at WMATA are thought to be due in part to this extensive surveillance system. The cameras are visible to patrons but easily could be overlooked; the monitoring screens in the station agent's booth (kiosk) are visible to patrons entering the system and are usually set-up in a way that makes them more noticeable. Hence CCTV also enhances the perception of security at WMATA.

In contrast to the situation at WMATA, other transit systems (MUNI, NJT-Rail, MBTA, and NYCTA) use CCTV at fewer stations, with fewer cameras, and with less visibility to patrons. NYCTA, MBTA, and NJT-Rail have CCTV at only one or two stations and are planning only selected extensions of the system. The main NYCTA installation is at the 59th Street-Columbus Circle station on Manhattan and has been operating about two years. Officials report that the crime rate at that station has been roughly stable while it has increased somewhat overall, concluding that CCTV has been somewhat effective. At SDTI there is one camera at each suburban trolley station, but their function is mainly to deter tampering with the ticket vending machines. Several transit systems, including NJT-Rail, NJT-Bus, NYCTA, and MBTA, reported that they are planning new CCTV installations. Officials point out, however, it is difficult to install an effective system in older style transit stations because of the poor sight lines. Installation in these situations is aimed partly at improving actual security and partly at improving perceived security.

A second use for CCTV is in the observation and protection of facilities. Office buildings, counting room buildings, maintenance facilities, and yard/depot entrances were among the applications observed. The cameras usually focus on entrances and exits, and are placed both inside and outside the buildings. At one system they are used to monitor activity at an alarmed emergency exit door so that if an alarm is given the security guard could immediately look at a monitor and determine the appropriate reaction.

A third use for CCTV is in the surveillance of employees in cash counting facilities. The cameras perform both a deterrent and an evidence-gathering function. In the two cases where the cameras are hidden from employees, the officials explained that the deterrence effect was greater if the employee did not know when surveillance was occurring (the employees were aware that the hidden cameras were in use). This factor was enhanced by the slow, unseen movement of the cameras and a monitoring booth that could not be seen by the counting room employees. The other extreme observed was a case where the cameras were visible and fixed, and the monitoring booth was unoccupied temporarily and visible to the employees. Both visible and hidden cameras have led to the identification of wayward employees. The more significant cases involved the installation of special, hidden cameras to monitor the actions of employees who became suspects because of other evidence; the cameras then confirmed the suspicions. A filming capability is used in these latter applications.

A nontransit facility visited uses CCTV to observe particular employees who are suspected of stealing from cash registers. Concealment cameras are installed over the register used by the suspect, and a videotape is made of the employee pocketing cash, thus providing strong evidence for a court case. The cameras are installed by special electricians employed by the security department to avoid possible tipoffs to the employee.

The NYCTA counting room is being modified so that activity in each counting booth will be filmed. The reason is that they would like to verify that shortages in the station agents' bags are due to a shortage of funds in the bags, and not due to theft by the money-counters.

Technical information on the design and operation of CCTV systems is provided in a report done for UMTA by Dunlap and Associates, Inc.[34]

4.3.2 Cameras on Buses

Two transit systems, AC Transit and SCRTD, have experimented with surveillance cameras on buses. The SCRTD experiment ended prematurely when the buses being used were taken out of service for other reasons, but AC Transit has been pleased with the results of their camera-on-bus experiment. The 8mm camera is located above and just behind the driver and is pointed toward the rear of the bus. A sign indicates that riders are under constant observation, but in fact the camera is only activated when the driver turns it on or activates the silent alarm.

The cameras are thought to function mainly as a deterrent to vandalism and graffiti and are used by AC Transit on routes with high rates of damage to bus interiors. Only 114 of the 800-plus bus fleet are equipped with the cameras, but the results are favorable and more installations are planned. No data were obtained regarding damage levels, so the size of the damage reduction impact was not established. Approximately $50,000 was spent for the cameras and installation.

4.3.3 Radio Communications

Radio systems commonly are used by transit systems for communications and deployment of police officers and transit vehicles. Battery-operated, mobile radios have become standard equipment for police officers and other operating supervisory personnel. The value of a good radio system cannot be overemphasized. To paraphrase an official at NYCTA, before radios the field officer would phone in periodically, but otherwise could not summon help or be quickly directed to a reported incident. Thus radios increase the effectiveness of police. At BART police radios have a "panic button" that the officer can push to summon help in an emergency when time or circumstances preclude the use of voice communications.

Radio equipment in buses and rail vehicles also is widely used. Most transit systems have working systems, and the others are planning to acquire them. Although their primary function is to assist in transit operations they also fulfill a role in the security area. The main security application is to summon help when a bus driver encounters a security problem such as fare evasion,

altercations and fights among passengers, or an unruly passenger who will not leave the bus voluntarily. Where buses serve high-crime neighborhoods the radio calls for assistance occur on a daily basis and are a key link in providing for the security of passengers, employees, and the transit vehicle.

There are technical differences among the radio systems in use at the transit systems visited for this study. The following general capabilities seemed most noteworthy. First, the more sophisticated systems include a programming capability so that the bus number, departure time, and route number automatically appear on a CRT screen at the control center during communications with that unit. This creates an inexact, but useful, vehicle location-monitoring system since the radio dispatcher has prior information about the route and trip length. Second, radios sometimes include a silent alarm function (see Section 4.3.4) so that the driver could inform the control center of an emergency without alerting the "suspect" individual that such a communication had been sent. Activating the silent alarm results in a beep or buzz at the dispatch center along with a display of the bus number and route. Third, some radio systems are single channel with all buses listening, while others have various arrangements for restricting radio communication when privacy of conversations is useful, e.g., when police vehicles are sent to assist in a criminal matter. Fourth, some larger systems have multiple channels with more than one person working at the monitoring center.

Most radio systems require relay stations to extend the communication area. Dead radio areas are a problem at several transit systems. Special provisions are made for underground radio communications at subway systems. Radio costs, given as rough approximations by officials, varied considerably depending on the features selected.

Transit authorities with functioning radio systems utilize them extensively. Written logs provide a good source of data regarding security incidents. At MBTA the normal procedure is for the police radio dispatcher to enter a report directly into a computer data base, but this capability was not observed at other transit systems.

4.3.4 Silent Alarms

Many of the bus transit systems contacted have silent alarm capabilities. The alarm is activated when the driver turns on a switch. The switch is always unmarked, usually within easy reach so that it can be activated without creating much notice, and is often protected so that it is not easy to accidently activate. One high-crime system reported that silent alarms are received at a rate of 2-3 per day for valid emergency situations and an additional 2-3 times per day for less serious situations or accidental false alarms. Other medium and large size systems reported lower rates but usually at least two per week.

When the silent alarm is activated a number of things can happen. At one small system the alarm only results in flashing strobe lights on top of the bus; for other systems lights flash and a radio message is sent automatically. Several systems also turn off the radio receiver, although it could be re-activated by the driver. Silent alarms on buses with electronic sign boards usually activate an emergency message on the sign board such as "Please call police."

When a silent alarm is received, the transit system dispatcher contacts the police and notifies them of the signal. At WMATA two levels of silent alarms are possible: (1) for more serious situations the silent alarm results in a radio message as described above; (2) in less serious cases the driver uses flashing lights and a verbal radio communication to describe the situation.

A special flashing light system is relatively inexpensive at about $200 per bus. The more complex radio and electronic sign board silent alarm components are more expensive, but, since the expense also serves other purposes it is difficult to determine the security portion of the costs.

4.3.5 Automatic Vehicle Monitoring Systems

Automatic vehicle monitoring (AVM) systems provide continual information on the location of operating vehicles. These systems combine electronic components that include radio transmitters, receivers, microprocessors, video displays, and a central computer. Small parts of two bus transit systems contacted (SCRTD and NYCTA) are equipped with complete AVM systems and several other transit systems

have programmed radio systems that provide some general vehicle location information (see Section 4.3.3). The main objective of an AVM system is to provide the operations department with information regarding schedule adherence so that service can be adjusted to meet operating conditions. Location information is also valuable, however, in the event of a security incident, especially if a silent alarm is activated. In an emergency the dispatcher can monitor the bus's movement and guide police to it. There seem to be relatively few such incidents because the specific areas covered by AVM are neither extensive nor especially high crime.

NYCTA is in the process of extending AVM to another part of its service area. The system utilizes fixed equipment at various street locations along the route and specialized onboard technology. Consequently the implementation of AVM is most efficient if all routes served by a given garage are jointly converted to AVM. This permits interchangeable scheduling of buses which is characteristic of transit operations.

4.3.6 Passenger Alarms

Three transit systems visited, BART, MUNI, and WMATA, have passenger intercom systems in rail cars. This equipment provides passengers with a means for notifying the train operator of problems, but does not provide a direct link with security personnel. Several transit officials noted the potential value of similar alarm systems on station platforms, but none were in use at the systems contacted. One transit system reported that it is studying the possibilities in this area, and another official said that public telephones are placed in stations partly to give patrons a means of communication in emergency situations.

4.3.7 Public Address Systems

Public address (PA) systems are used in rail transit stations to make informational announcements. This provides an opportunity to inform patrons of the rules and ordinances covering transit stations and vehicles, such as prohibitions against smoking and drinking. Coupled with reasonable enforcement efforts these announcements can help develop an image of lawfulness on the system that can bring benefits in other areas.

A unique PA application was encountered at NYCTA. Some buses have PA systems that permit the dispatcher to talk directly to patrons. As in the rail station application, use of this system can create an atmosphere of law and order on buses. It also provides a more direct security impact when the driver uses his radio to report a serious on-going incident. The dispatcher then warns the offending patrons and informs them of actions to bring in outside help. Most criminal or anti-social activity ceases at this point. Use of this system in high crime areas would seem to have potential benefits, but it has not been used in that situation to date.

4.3.8 Chemical Mace

SCRTD has distributed and authorized the use of chemical mace to bus drivers whose routes include high-crime areas. The bus drivers are given training in how and when to use the mace. In general it is reserved for situations in which bodily harm to the driver or passengers is likely.

Giving drivers mace is a relatively extreme reaction to a serious crime-risk situation. Its frequency of use and effectiveness was not ascertained.

4.3.9 Police Dogs and Guard Dogs

Police with trained dogs are used to patrol subway stations and vehicles at NYCTA, MBTA, and SEPTA and were used for a time at BART. The APTA Security Guidelines Manual contains a section describing the advantages, drawbacks, and costs of using patrol dogs. In discussions with transit officials it was emphasized that the canine (K-9) patrols had a major impact on the patrons' perception of security and were a useful substitute for 2-officer patrols. MBTA and NYCTA both reported that approval and funding had been received for expanding their K-9 corps.

NYCTA uses guard dogs at night to maintain security in a fenced area. The dogs are rented at a cost of about $33,000/year. Note, however, that the cost includes the daily pick-up and delivery of the dogs. A key advantage of using dogs is that they are a regular outside presence that does not require supervision. This is in contrast to night watchmen, who, according to an official at one transit property, are unreliable, sleepy, averse to inclement weather, and poorly trained.

4.3.10 Lighting and Visibility

Adequate lighting is a deterrent to crime. In designing new transit stations, good lighting and visibility are a security consideration. Satisfactory illumination contributes to less crime and less fear. Long range plans to refurbish transit stations at MBTA and NYCTA include lighting improvements.

New bus shelters usually are constructed with transparent acrylic sides. A patron is more comfortable knowing that the shelter does not hide a potential mugger, and that any passerby can see inside the shelter. At RIPTA some of these acrylic shelters are also equipped with lights for improved night visibility.

4.3.11 Dedicated Telephone Lines

BAT uses a dedicated telephone line between its main passenger terminal and Brockton Police Headquarters. If the duty officer or any other BAT employee desires police assistance this telephone is used and the call will get an immediate response. Dedicated telephone lines are also used for emergency communications between token booths and a central control room at NYCTA.

4.3.12 Computer Systems

There are two main applications of computers to the transit security area: (1) the collection and analysis of crime data; and (2) the accounting and auditing of transit revenues. Contacts with transit industry officials indicated that use of computers for security is changing rapidly. Two systems (MBTA and NYCTA) have operational computerized crime reporting and analysis systems, and most of the other transit systems have begun the process of establishing such systems. On the revenue side the extensive and repetitive dealing with numbers provides opportunities for advantageous use of computers. Although many computer applications in the revenue area were observed, there are also many cases where various computations, record keeping, and auditing checks are being done manually.

At transit systems with formal police departments there is usually a careful record keeping system for all crime incidents. The emphasis by police on record keeping is partly a legal matter to aid in successful prosecution, partly a practical necessity to identify repeat offenders, and partly a requirement to

conform with the U.S. Department of Justice's (FBI's) Uniform Crime Reporting Program. Crime data are also supplied to one or more computerized "clearinghouses" or data bases including the NCIC (National Crime Information Center), and its various state and local counterparts.

While two transit systems contacted (MBTA and NYCTA) have computerized crime record keeping systems, and others are nearing that stage (AC Transit, BART, NJT-Rail, SCRTD, STM, and WMATA), there is a wide variation in the approaches selected. For example, some transit systems rely on large mainframe computers that serve other non-security functions, while others have micro-or mini-computer systems dedicated to the security area. In addition most transit systems develop their own security software. At BART, a software system has been "borrowed" from another system (Overland Park, Missouri) and is being adapted for use on BART's IBM mainframe computer. The variation in software reflects differences in both the information collected and the output reports available to guide anti-crime efforts.

Computerized crime record keeping also can serve an internal security function. A large private firm maintains computerized records on all individuals apprehended by their security department in the past five years. They check these records as part of a pre-employment screening process.

Computers are used at several transit systems to assist in revenue accounting. At AC Transit readings from electronic fareboxes are obtained and automatically entered into the computer when the vaults are emptied. The data are tabulated by the computer so that there is an accounting of money going from the vaults to the safe. When the contents of each safe are counted they are then checked against the computer's estimate, and this serves to deter and identify any fare theft. MBTA follows a similar procedure with the difference being that registering farebox readings are taken by hand and later entered into the computer. BAT is unique in that farebox readings and money counts are reconciled for each farebox; the data are entered into a microcomputer and a software system notes discrepancies beyond threshold levels. At other systems revenue records and reconciliations are done with calculators.

4.3.13 Patrol Vehicles

Transit systems with police and/or guard units have radio-equipped patrol cars available to provide mobility for their staff. Some vehicles are unmarked for use in situations where anonymity is desired, e.g. escorting buses in high-crime areas. Vehicles are needed in rail transit security when train service may be interrupted during a security incident. They also are used to transport persons who have been arrested.

Officials at one transit system complained that there were too few vehicles available and that any available vehicles were in poor repair. It was noted that response time suffered because of vehicles that could not be driven safely at high speeds and, in one case, became disabled while responding to a call for assistance.

At BART two dirt bikes are used to patrol areas where trains are above ground. The patrols are concentrated in areas where vandalism and missiling incidents occur. The bike patrols function as a crime deterrent by showing a police presence, but few arrests are made.

4.3.14 Vehicle Theft Prevention Hardware

Conversations with and questionnaires received from various government officials identified several hardware systems aimed at thwarting vehicle theft. The Federal Motor Vehicle Safety Standard, "Theft Protection," applies to passenger cars, trucks and multi-purpose passenger vehicles of less than 10,000 pounds gross weight. It requires, among other things, that each vehicle have a key-locking system that, whenever the key is removed, prevents normal activation of the vehicle's engine and prevents steering and/or self-mobility of the vehicle.

Most transit buses do not have ignition key-locking systems. However, there are a variety of theft prevention devices that may be adapted to bus security. These devices include system interrupters, alarms and specialized locks. System interrupters disable the ignition, the fuel supply, or some other vital system to prevent the vehicle from being driven. Alarm systems rely on a thief's unwillingness to attract attention presuming that a loud noise will preempt efforts to steal the vehicle. Finally, specialized locks either impede entry .

into the vehicle or interrupt the operation of a vital system in the vehicle such as the steering column. Disabling such locks requires more time or knowledge than many thieves will have.

4.3.15 Emergency Response Equipment

The BART police department has an emergency response vehicle with a mobile communications center, a holding tank for prisoners, fire masks, and other specialized equipment. A "SPAR" (Special Problems and Rescue) team uses this vehicle in responding to emergencies. Other transit systems reported that they would rely on local police agencies for support in situations involving bombs, hostages, terrorism, etc. In some cases planning efforts had identified contact points for specialized services such as bomb squads, bomb trucks, and SWAT (Special Weapons and Tactics) teams. Some systems, however, seemed unsure about who to contact or which of the local police departments had such resources available.

4.3.16 Uniforms

As noted in Section 4.2, transit police wear "military" uniforms conveying a peace officer image which tends to improve their effectiveness. Security guards generally are uniformed in a similar manner, and where they regularly deal with transit patrons, the uniform is considered a key advantage. Since the guards do not have police powers, their uniforms may facilitate a degree of cooperation to which they are not legally entitled. For example, a disorderly person may be removed from a transit vehicle and detained until police arrive even though the guard's only means of preventing the person from walking away is the legally cumbersome citizen's arrest. (A citizen's arrest would only be utilized in an extreme situation because of potential lawsuits.) For this reason many firms supplying transit security forces use uniforms that maximize the police image and minimize the fact that they are not sworn police officers.

Another aspect of police uniforming mentioned at several transit systems was the use of bullet-resistant vests. It is standard procedure for officers at BART to wear such vests when on patrol duty. Other departments have vests available for optional use, while they are not used at all at some transit systems.

Effectiveness and cost are key considerations in the decision to provide bullet-resistant vests. One official noted that less expensive vests were less effective in stopping bullets and provided no protection to a person's back and sides.

4.3.17 Fencing

Transit systems often secure buildings, yards, right of way, and parking lots with fences. Conventional chain link fencing, sometimes with barbed wire at the top, is commonly used with mixed results. Several officials noted that such fences could be cut or even pushed over, so they would not stop a determined individual.

Two more effective fencing alternatives are being used at NYCTA, mainly to keep graffiti artists out of rail yards. In one application a double fence is installed and guard dogs are kept between the two fences. The other application involves the use of "razor ribbons" instead of barbs. The "razor ribbon" is a coil, roughly two feet in diameter, with many sharp metal razor surfaces interspersed. The coils are used both at the tops of fences and, in some applications, between two fences (instead of dogs). Officials report that fences equipped with razor ribbon coils are virtually 100 percent effective.

4.4 REVENUE SECURITY MEASURES

4.4.1 Introduction

Mass transit revenue collection is a multi-stage process whereby the fares deposited by individual patrons are aggregated, counted and eventually deposited into a bank account. Once in the bank, this revenue can be drawn upon to pay for transit systems' operating expenses. As the federal government reduces transit operating subsidies, it becomes increasingly important that each patron pay the required fare and that all fares received ultimately reach the bank. Because of the cumbersome physical process necessary to collect and aggregate fares, there are numerous steps along the way at which revenue can be stolen (see Section 3.3).

Fare collection methods vary according to the type of transit systems involved. For bus systems, fares are collected on board the vehicle,

usually by means of a farebox located next to the driver. At the end of its run, the bus returns to a garage or depot where farebox revenue is taken off the bus and stored in a vault. Revenue may be counted at the garage or transported to a central facility for counting.

For heavy rail transit (subways), fares are usually collected in the station before the patron boards the train. Access to trains is controlled by a turnstile or other type of gate, which the patron releases by depositing the correct fare. Revenue is collected from the station, by a revenue truck or train and is taken to a central facility for counting.

Light rail transit (trolleys) is somewhat of a hybrid as far as revenue collection is concerned. In most cases, fare collection takes place on board the vehicle. In some cases, however, fares are collected in the station.

Barrier-free systems, such as the new SDTI, represent another variation in revenue collection. On this type of system, patrons purchase tickets prior to boarding the vehicle. On board, inspectors make random spot checks to verify payment.

Since revenue can be pilfered at any point in the collection process, many transit systems establish an audit trail of revenue by counting it at different stages to ensure that it is all still present. This counting may be performed manually, mechanically, or electronically. In that revenue counting adds time and expense to the collection process, transit systems vary in the extent to which they track revenue.

Revenue typically gets counted as it enters the system at the farebox or the turnstile, using mechanical or electronic registers. Not all systems, however, count revenue at this point. At a minimum, all systems count aggregated revenue before it is sent to the bank as a check against the bank's count.

In addition to establishing an audit trail, transit systems may secure revenue through physical measures, such as locks and keys, tamperproof equipment, and alarm systems, as well as through surveillance of employees by co-workers or supervisors and by CCTV or surveillance cameras. The extent to which such measures are employed on individual transit systems varies considerably.

4.4.2 Bus Revenue Security Measures

4.4.2.1 Countermeasures to Fare Evasion on Buses - Ensuring that all patrons deposit a fare is the first step in the revenue collection process. Since there are no physical obstructions to entrance, such as turnstiles or gates, the patron is free to walk past the driver without paying a fare. Demanding that fares be paid can lead to driver assault. Most transit systems would rather forfeit fares for the sake of the driver's safety. A compromise position of requesting payment, but avoiding arguments seems to be favored by a number of systems.

Since drivers are in such a vulnerable position, enforcement of fare payment is often left to someone else. If fare evaders are on the bus when it reaches a station or depot, the driver may signal the dispatcher or on-duty officer who will demand payment.

If a driver notes repeat fare evaders or if fare evasion is common on a particular route, undercover agents may be assigned to ride the bus and apprehend fare evaders. In some cases, the bus will be followed by an unmarked car. Undercover agents may be transit supervisors, transit police, local police or private security personnel. Persons caught evading the fare may be arrested or issued citations.

In less threatening situations, exerting social pressure can be effective in collecting fares. As part of an AVM system used by NYCTA at their Queens Village Depot, the dispatcher at the communications center can speak over the bus' PA system requesting that patrons pay their fare. Electronic registering fareboxes recently introduced on the market, such as those in use at AC Transit, emit a "beep" sound when the correct fare has been deposited. In this way, the driver and other passengers know when someone has evaded paying the fare.

Several systems have reported more fare evasion when fares are paid upon exiting the bus than when fares are paid upon entering the bus. RIPTA found that fare evasions were more common when they operated under the "pay leave" system. BAT has more fare evasion on their outbound "pay leave" buses. For these buses, BAT now requires payment on entering for known fare evaders, for groups of youths and for all passengers during evening hours.

"Short-changing," depositing some but not all of the fare, is another problem that plagues bus systems. With new electronic fareboxes, coins and currency fall into the box and are displayed against a glass plate on the side of the box for the driver's inspection. In addition a "beep" is emitted if the correct fare has been deposited. This system gives the driver considerable leverage in requesting full payment.

Use of half dollar bills is one type of short-changing. This is a problem on systems that accept dollar bills and where bills are deposited together with coins into the farebox. The new fareboxes, which display the full bill through a glass plate for the driver's inspection, offer a technical solution to the problem. After installing such fareboxes, AC Transit's problem with half dollar bills (200 a day) has all but disappeared.

At STM half dollar bills were also a problem. Currently drivers ask passengers to display bills unfolded before depositing them into the farebox. STM is purchasing new fareboxes that will have a separate bill transport. In order to deposit a bill in this farebox, it must be unfolded.

Counterfeiting of fare media is another form of fare evasion. Many transit systems issue passes for riding at reduced rates. These passes can be copied and/or sold to unauthorized persons. Even colored passes can now be fairly easily duplicated using color copying machines. However, there are various printing techniques available that prohibit easy duplication. For example, AC Transit has started using foil as a background on the pass to prevent photocopying. Laminated photo ID passes, although more expensive, are more difficult to counterfeit. Use of such passes at STM apparently has reduced counterfeiting attempts.

Theft of pre-printed transfers is a problem at some transit systems. The use of electronic transfer dispensing machines has helped to alleviate the problem of transfer abuse. The transfer machine dispenses tickets as needed from unprinted paper. As the transfer is issued the prescribed design, time, date and location are printed on the paper. Such a device makes theft of transfer material less profitable.

MUNI recently undertook a comprehensive campaign aimed at reducing all types of fare evasion. The program, which was developed in conjunction with the transit union and local police, was accompanied by a major media campaign ("No Fare is No Fair"). An explicit procedure was developed for dealing with fare

evasion situations. When a fare evasion occurs, the driver notifies the dispatcher giving the vehicle's location, direction of travel and a code specifying the seriousness of the situation. The dispatcher immediately arranges for a specially designated "transit line coordinator" and a police officer to intercept the vehicle. During its first five weeks, the campaign stopped 339 fare evasions and probably deterred many others.

Courts often do not treat fare evasion as a serious offense. Efforts to communicate to the courts the overall impact of fare evasion can be beneficial. At MUNI, an effort was made to contact juvenile court judges to make them aware of the aggregate effect of fare evasion and the importance of treating it seriously. Recordkeeping on fare evasion arrests can be important since courts are more likely to pass out strict sentences to repeat offenders.

4.4.2.2 Farebox Security on Buses - Fareboxes are designed to be secure from tampering by drivers or other unauthorized personnel. Fares fall through the box into a vault at the base of the farebox. With the proper key, the bottom of the farebox can be opened and the vault removed. The vault automatically locks upon removal, and another key is necessary to open the vault. For farebox maintenance, the "bellyband" around the middle of the farebox is removed in order to disconnect the top portion for repairs. At all other times the bellyband is locked in place. If drivers or others can remove the bellyband, it is possible to either intercept revenue before it reaches the vault or to reach into the vault and take revenue. Drivers do not have access to farebox, vault, or bellyband keys, however, a breach in key control through carelessness or collusion can provide drivers with the opportunity for skimming. On NYCTA buses the bellyband is secured with a cable lock. The loop of cable must be cut to open the lock. The advantage of this keyless lock is that no break-ins can pass undetected.

The increasing use of dollar bills has created some security problems. When bills are deposited in fareboxes along with coins, they increase the likelihood of farebox jams, resulting in the kinds of security problems described above. On the other hand, if bills are given to the driver the possibilities for skimming are increased. At STM and SCRTD, drivers are strictly forbidden from handling money. This policy allows for no excuses if a driver is caught with money.

"Spotters" are used on buses by some transit authorities to observe drivers suspected of skimming. This can serve as a preventive measure if drivers are made aware of the spotting.

"Salting" fareboxes with marked bills or coins is another method for uncovering skimming activities. If the aim is to prosecute, rather than to simply dismiss the driver, evidence must be gathered with particular care. At one system a serial number on one of the marked bills had been copied incorrectly, and although the driver was caught taking bills the judge dismissed the case. Another system was not able to prosecute a particular driver because marked bills were found in his locker rather than on his person. As with the use of spotters, salting fareboxes periodically is a good check on driver honesty and, if drivers are aware it is taking place, it is also a good deterrent to theft. Periodic salting of store registers to monitor employee behavior is also a practice in the retail industry.

Using a register to count revenue deposited in the farebox can provide a check on driver skimming. Not all systems use registering fareboxes, however. On some systems, farebox registers are inaccurate or inoperative. Other systems use registers only as a check on aggregate revenue, such as for each garage. Using aggregated data can be useful in detecting revenue shortages, but does not provide a check on driver skimming. The only thorough check is to record the amount of fares registered per farebox and compare it with a count of the contents of the farebox vault. This method is difficult when there are large numbers of fareboxes. One small bus system visited, BAT, does a vault-by-vault count for comparison with register readings.

RIPTA and MBTA do occasional spot checks, counting revenue from selected farebox vaults and comparing these counts with register readings. To be effective such checks should be done routinely; to act as a deterrent, drivers should be made aware of these checks.

Jammed fareboxes provide an opportunity for revenue skimming by maintenance workers. Unregistered money accumulated in the top of the farebox is vulnerable to theft as is revenue in the vault once the top portion of the box is removed for repairs. Transit systems have instituted various procedural measures to deal with this problem. At NYCTA a supervisor must be present while a maintenance worker repairs the farebox. The top portion of the box is removed and brought to

the farebox room where the unregistered revenue is counted and placed in a portable vault. A sheet indicating the amount of unregistered revenue collected is sent to the revenue department.

The MBTA is trying to establish a monitoring team to oversee farebox repair. In the meantime, under a new set of rules, repair persons must place all unregistered fares in a locked bag. This bag must be closed and locked before the individual leaves the vehicle. The intent of this policy is to prevent the surreptitious removal of revenue from the bus. At AC Transit, where repairs are done "on the road," it is company policy that both a maintenance worker and a treasury employee be present when repairs are made.

Better farebox reliability would reduce access by maintenance workers to farebox revenues. In general, nonregistering fareboxes seem to present fewer maintenance problems than registering fareboxes. STM experimented with registering fareboxes, but returned to using nonregistering fareboxes because of overwhelming maintenance problems. Even nonregistering fareboxes are susceptible to jamming due to influxes of dollar bills.

Newer electronic registering fareboxes seem to have presented particular maintenance problems at some systems. On the other hand, the new electronic fareboxes now in place at AC Transit operate virtually jam-free. Paper jams occur on average only once a month, and jams due to damaged coins have been eliminated through a specially designed farebox cover which intercepts these coins. The primary reason for AC Transit's impressive record on jams is the existence of a strong preventive maintenance program which these boxes seem to require.

Purchase and proper maintenance of this type of farebox could provide a solution to the jammed farebox problem and hence to the problem with revenue security during farebox maintenance. However, this may not be a practical solution for all transit systems. On systems where jams remain frequent, procedures that improve surveillance of maintenance activities are important.

4.4.2.3 Revenue Transfer From Buses - Revenue is removed from buses, usually on a daily basis, at garages or depots. Revenue removal usually is done in conjunction with other maintenance activities, such as bus refueling. Once

removed, revenue may be counted at the garage and later transported to a bank, or it may be stored, awaiting transfer to a central counting room. Smaller bus systems tend to count revenue at the garage, while larger systems tend to have central counting rooms.

Two primary revenue removal systems are in use on U.S. transit systems, vault pulling and vacuuming. During a vault pulling operation, the puller unlocks the farebox and removes the vault, which automatically locks itself upon removal. The pulled vault may be sent to the counting room, stored in a vault room, or emptied into a larger vault for storage. If a vault is emptied directly after pulling, it is usually placed back into the farebox immediately (one vault system). If it is sent elsewhere, a second empty vault is usually placed in the farebox (two vault system).

Vaults generally are opened only when they are inside the counting room, and at most systems vault pullers do not have vault keys. An exception to this occurs at one small system where pullers also are responsible for counting revenue. The presence of other transit employees in the area adds some security as does a careful audit trail on revenue maintained by management.

At another system visited, vault pullers, working alone, have devised ways to keep vaults from automatically locking, and skimming by pullers has been a significant problem. Some kind of surveillance - personal or electronic -is a useful safeguard for vault pulling operations since lock systems can often be tampered with. At AC Transit two CCTV cameras are used to monitor each vault pulling area.

At some systems, farebox vaults are emptied into larger storage vaults before transport to the counting room. At AC Transit the puller places the vault into a vault emptying device. A system of keys allows the puller access to the opening for the vault, but not to the vault itself. Revenues are dumped automatically into the larger storage vault. Such a system improves security by eliminating access to revenue.

Some type of vault inventory or control system is desirable to prevent unauthorized switching of vaults. At STM daily checks are done to match each vault and bus. At AC Transit empty vaults are under strict controls. They are

kept in a secure area. If an empty vault is required, a supervisor must be called and the use of the empty vault recorded.

When a vacuum system is used to remove revenues, money is transferred directly out of the farebox and into large vaults inside the vacuum machine. The vacuum system sorts revenue by denomination, depositing it in separate vaults. By eliminating vault handling, the vacuum system reduces some revenue security problems. However, it also introduces some security problems of its own. NYCTA and WMATA have made several modifications to their vacuum equipment that address some of these issues.

At NYCTA, when the vacuum hose is inserted into the farebox, the vault door opens and when the hose is removed, it automatically locks. In some instances, however, the vault door remains open after vacuuming. When the vault is in this condition, known as "free wheeling," revenue can be removed from the vault manually, creating the opportunity for skimming. NYCTA has modified its farebox by adding a panel of lights on the side of the box to help monitor revenue collection and transfer. One light indicates whether the vault door is open or closed. This light is used to ensure that buses do not leave the garage in a "free wheeling" condition.

Another security-related modification is the installation of a yellow light on the top of the vacuum machine. This light flashes whenever the doors allowing access to the vault area are open.

Because of the large number of quarters collected by NYCTA, a modification to the vacuum machine allows a shift to a second quarter vault when the first is full. Without this shift, quarters would overflow the vault and fill up the interior of the machine.

WMATA, like NYCTA, has also made changes to their vacuum system. A security-related modification is the alarming of the vacuum vaults. This system reports the amount of time used to change vaults so that any unusual activity will be noticed.

Whether revenues are to be counted at the garage or to be transmitted to a central counting facility, they usually remain in the garage overnight awaiting pick-up the next day. Since revenues are usually in large storage vaults, they are not particularly vulnerable to theft. Most often, they are stored in a

locked room. In the case of the MBTA and STM, the room is monitored by an ADT alarm system. Revenue counting room security for both bus and rail is discussed in Section 4.4.4.

4.4.3 Rail Revenue Security Measures

4.4.3.1 Countermeasures to Fare Evasion on Trains - Fare evasion on rail systems is of a somewhat different character than fare evasion on bus systems due to different ways in which passengers enter the system. In contrast to bus systems, rail systems usually present a physical barrier to entry (i.e. turnstiles or gates). To evade the fare the patron must circumvent the barrier, e.g. by jumping the gate or depositing illegal fare media, such as slugs. Fare evasion on rail systems may be easier to prevent because of the existence of a barrier; on the other hand there is often no one near the barrier to apprehend fare evaders.

Newer systems with automatic fare collection equipment experience similar fare evasion problems similar to those of older systems. On these systems, instead of using slugs, fare evaders have found ways to manipulate the magnetic stored-value ticket system to their advantage. BART uses "spot" teams to apprehend fare evaders during the morning rush hour. In some cases fare evaders are arrested; in other cases citations are issued which carry a fine of $35 to $50. BART collects from approximately 85 percent of those cited.

On SDTI's barrier free system, patrons purchase tickets on an honor system. Inspectors, boarding trains randomly, check for valid tickets and issue citations to offenders. SDTI's low rate of fare evasion, reportedly under one percent, demonstrates the deterrence effect such a system of random checking can accomplish.

4.4.3.2 In-Station Revenue Security - Revenue collected and stored in rail transit stations is vulnerable to both internal and external theft. On older transit systems attendants, located inside change booths in each station, sell tokens and make change for patrons. These change booths operated by a single

unarmed individual are easy targets for robbers. As a security measure, some systems have equipped their booths with bullet-resistant glass. In some cases change booths also are equipped with silent alarms. At one system visited, the booth is also equipped with a microphone pickup, which simultaneously transmits any sound from the booth to a loudspeaker at headquarters. This microphone is activated by the same switch as the silent alarm. Such a sophisticated alarm system is only effective if the police respond quickly.

Because of possible collusion between robber and booth attendant, one system has adopted the policy that booth attendants should stay inside the booth and refuse to turn over money. They are liable for any money lost during a robbery unless there are extenuating circumstances. Such a policy is tenable only because the booths are equipped with bullet-resistant glass.

On newer systems, such as WMATA and BART, AFC equipment, including ticket vending machines and change making machines, have replaced change booth operations. Revenue collected in these machines is vulnerable to theft, particularly if stored overnight. At WMATA where nighttime burglaries of ticket vending machines were frequent, implementation of several security measures has all but eliminated the problem. A new stainless steel T-handle was installed on the machines making entry more difficult, and patrols of stations during nonoperating hours were increased. Apparently the more difficult entry and the greater probability of detection make ticket vending machine burglaries an unappealing proposition.

At SDTI ticket vending machines are located outdoors in open stations. Initially, several burglaries occurred in which thieves broke off the cast metal handle to the vault area. Retrofitting a stainless steel "donut" over this area has eliminated the problem. The vending machines have a loud battery-powered alarm that is activated in the event of forced entry.

In addition to robberies and burglaries, internal theft of revenue during station revenue collection activities is a source of concern on both older and newer systems. Because they work unsupervised, the primary control on change booth operators is an accounting of revenues collected. Booth operators start with a "bank" of coins, bills and tokens. This must be accounted for at the end

of their shift. Excess revenue is bagged and placed in a drop safe. Generally booth attendants are responsible for any shortages over a low threshold amount. At NYCTA booth operators also are responsible for pulling turnstile vaults at the end of their shift. Meter readings taken at the beginning and end of the shift must correspond with the number of tokens in the vault.

Revenue collected by AFC equipment is audited using registers to show how much has been collected. At BART a cash count is recorded manually when the cash bag is pulled from the machine, and the same count is simultaneously transmitted from the machine to a computer. These two counts, as well as the count done by the counting room, must match. Any shortage greater than $5.00 is investigated. This system provides a tight accounting of collected revenues.

Despite careful auditing procedures, BART and WMATA still have problems with internal theft from AFC machines. At WMATA where "salting" of cash and surveillance activities have been used as countermeasures, 11 station agents have been arrested during the past year.

Better machine reliability would improve the situation. Jammed machines provide the station attendant with a good excuse to enter the machine. SDTI, which has a strong preventive maintenance program for their ticket vending machines, apparently does not experience these problems of employee theft. Redesign of machines to allow the clearing of jams without access to cash would also help to solve the problem although it could be an expensive solution.

4.4.3.3 Revenue Transfer Security Measures - Revenue pickup from transit stations varies from system to system. Revenue may be stored overnight in the station or picked up the same day. Revenue trucks or revenue trains may be used to transport cash to the counting room. The degree to which security precautions are taken to protect revenue varies considerably among systems.

One of the more secure collection systems was observed at BART. On this system cash is transported in an armored truck equipped with a silent alarm and protected by an armed security guard. The truck is followed by a radio-equipped car, driven by another armed guard. At the MBTA all persons involved in cash pick-up, typically four workers per truck, are armed. Good practice, followed at many systems, includes variations in routes taken and in pick-up times.

Several rail systems use revenue trains to pick up revenue from stations. On the NYCTA, revenue trains travel the different lines collecting revenue during late night hours. Collection agents take cash/token bags directly from the change booth drop safes to the revenue train. They carry tumblers which give them access to these safes. The NYCTA revenue trains are accompanied by eight-to-ten collection agents and one police officer, all armed with shot guns.

4.4.4 Counting Room Security Measures

Controlled access to counting room facilities is required to avert robberies and to prevent employees from surreptitiously leaving the premises. Multi-door systems are one method commonly used to control access and egress. Typically inner and outer doors cannot be opened simultaneously. A logging-in procedure is often required as a further control on access.

For those working inside the counting room, transit authorities establish various procedures in an attempt to prevent employee theft. Such procedures, although not foolproof, serve to let employees know that management is serious about stopping theft.

Pocketless uniforms are required at NYCTA, SCRTD, STM, and BART. At SCRTD a supervisor must be present while employees change from their uniforms into their personal clothing. In addition to wearing uniforms, NYCTA employees must keep their personal belongings in a clear plastic pouch, provided by the authority, in a location visible to supervisors. SCRTD employees are also required to store their valuables inside safety containers before entering the counting room. Any cash found on an employee inside the counting room is considered "system money."

In addition to these procedures, some type of surveillance of employee activities is desirable since procedures can always be circumvented. The presence of other individuals, supervisors or co-workers, acts as a deterrent to theft, although collusion is always a possibility. At the MBTA supervisors circulate around the counting room periodically to monitor employees. At SCRTD, two or three security guards are present during money counting operations, although their presence is primarily directed towards external theft.

BART requires that groups of employees work together, providing some peer pressure against theft. A system used by Brinks in counting revenue for AC Transit seems to be a more effective version of this group system. Known as "triple custody," this system requires all counting to be done in groups of three people who monitor each other. Each group is changed regularly to reduce the opportunities for collusion.

Electronic surveillance is another method for monitoring employees. The use of cameras can act as a deterrent to theft, as well as a means of detecting fraudulent activities. SCRTD, BART and WMATA currently use CCTVs in their counting rooms. The MBTA and NYCTA are planning to install CCTVs in the near future.

The BART counting room is equipped with eight CCTV cameras including the "Black Eagle," a moving camera that travels along a track across the counting room behind a shield of dark glass. Counting room staff do not know the location or the orientation of the camera. The covert nature of this camera should increase its deterrent effect. At one system visited, management uses temporarily-installed surveillance cameras to monitor the activities of individual employees suspected of theft.

A final way to detect counting room theft is through the use of an audit trail. Some bus systems use their registering fareboxes to estimate aggregated expected revenues such as revenues by garage. This allows them to identify any sizable revenue shortages and thereby guide investigation efforts.

For rail systems, as noted earlier, proceeds from individual station booths and AFC machines are verified in the counting room. Shortages over some threshold amount are the responsibility of the booth or station attendant. However, if a counter consistently calls shortages, suspicions that the counter is skimming are aroused.

At large bus and rail systems, revenue is usually counted at large central facilities under fairly tight security. For smaller bus systems, however, counting is often done on the premises, and security measures are more informal. Surveillance is provided by the presence of other workers, and sometimes appears to be rather haphazard.

At STM revenue counting is done by one counter working in a glassed-in room. The visibility of this glassed room, which faces the transit system's office

area, including the general manager's office, provides the primary security measure for revenue counting activities.*

At RIPTA counting is done in a small room adjacent to the maintenance area. The room is locked, and has one window which faces the maintenance area. The requirement that two counters be present in the room all the time seems to be the primary security measure.**

At BAT the puller-counters do their counting in an open area on one side of the garage. The presence of other workers -fuelers, washers, maintenance workers - provides some deterrent to theft.

Managers at these smaller systems claim that because their money counters are known and trusted individuals, theft is less likely. Whether the more closely knit atmosphere at these smaller system does, in fact, provide a deterrent to crime is a matter of debate.

4.5 INTERNAL INVESTIGATIONS

There are various levels of internal investigations that occur at transit systems. Employees investigated include vehicle operators, station agents, cash counters and mechanics. The investigations may be spontaneous, but most often are conducted in reaction to an unexplainable loss or a specific suspicion. In most cases, internal investigations are initiated and conducted by transit security officials and, in cases involving revenues, the treasury department may participate. Private contracting firms are periodically hired to provide personnel for investigations. Larger systems, such as SCRTD, have special security divisions that are responsible for both internal and external investigations. A number of security officials contacted believe that their ability to conduct an internal investigation is inhibited by prescribed levels of command. These officials feel it is important for the security chief to report directly to the general manager. Otherwise, information concerning the investigation can quickly filter down throughout the system eliminating the secrecy necessary for a successful inquiry.

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*As of September 1983, STM also requires that its money counters wear pocketless uniforms.

**Since our May 1983 visit, RIPTA has installed a video camera in the counting room, with monitors in the Transportation Office, General Manager's office and Treasurer's office.

Many examples of internal investigations of transit employees already have been presented. These cases concern both the mishandling of transit revenues and the theft of transit property. The majority of these investigations are not ongoing programs, but reactions to specific incidents. A treasurer at one system commented that such investigations should occur on a regular basis as a preventive measure, not simply in response to particular suspicions.

There is little evidence of investigations of white collar crime. Security officials feel inhibited in the conduct of such operations because of the various levels of command that must be consulted beforehand. Such consultations would likely alert the individual intended for investigation. External audits of revenues and expenses are performed regularly, but some security officials believe that such audits are insufficient to uncover revenue malfeasance.

4.6 LEGAL SYSTEM RELATIONS

Legal systems can both inhibit and assist transit security efforts. Until recently, legal decisions tended to inhibit the ability of transit police to enforce laws and ordinances in the transit environment. In the past few years, some changes in the legislative and judicial systems have begun to favor the enforcement of transit security.

Lapses in transit security often involve many small problems, which when combined assume much greater significance. Prime examples of this phenomenon include graffiti, fare evasion and revenue skimming. One characteristic of this type of crime is the fact that it is often difficult to prosecute offenders. Juries often will not convict someone of a crime if they themselves have committed that crime, especially if the impact of the crime appears to be small. Examples of such crimes include drunk driving and minor theft. In one case, a Washington DC jury issued a not guilty verdict when there was clear evidence that a station attendant had stolen $8.00 from a ticket vending machine. Afterwards, members of the jury agreed that the attendant was guilty, but explained that $8.00 was an amount too small to be treated as a serious crime. Subsequently, WMATA limits arrests and prosecutions to cases which involve larger sums of money.

A major weakness in the Washington DC system is the fact that individuals may request jury trials for misdemeanors. However, even in other areas, where

such cases do not reach a jury, judges also have been lenient toward transit offenders. Many judges are reluctant to burden an individual with a criminal record for a minor transit ordinance violation. For example, judges often consider fare evasion to be a minor crime of little financial consequence. Even when courts do demand restitution for acts of vandalism, judges typically fail to account for the labor costs involved in the replacement of broken parts. Using a nontransit example, the lesser crime of shoplifting is often not treated seriously in a court which primarily deals with more serious criminal offenses.

Many transit related organizations are lobbying for new legislation and awareness regarding the impact of transit crimes. NYCTA recently introduced legislation to make subway robbery a felony, but the bill failed to pass the legislature. The State of Rhode Island enacted a law in 1981 making assault of a bus driver a felony punishable by a fine of $500 or up to five years in prison. The State of California has three special acts of legislation that relate to mass transit crime. First, malicious mischief of greater than $1000 in damages to transit property is considered a felony. Second, assault of any transit employee is also a felony. Finally, the most recent legislation allows citations to be issued for minor transit offenses. The law allows for a maximum fine of $50.00 for violations such as smoking, eating, or radio playing while on transit property. In January of 1984 this law will be altered to include juveniles and further changes are under consideration to increase the maximum fine to $250.00. Jury trials are not allowed under this legislation. Fines collected from these transit ordinance violators are used to help finance the training for new transit police officers.

In addition to changing legislation, transit systems have engaged in lobbying efforts to make judges more aware of transit ordinance violations and their impact. At NJT-Rail, security officials have contacted juvenile court judges to make them aware of the aggregate impact of fare evasion and the importance of treating it seriously. In 1982 officials from WMATA met with the chief judge of the Washington DC Court and arranged a system of citations and fines for enforcing transit system regulations. Twenty-five dollar fines are now issued for minor violations which are treated by the courts like parking violations. Finally, when WMATA was extended to Maryland, transit officials held

an information and education meeting with 16 Maryland judges. At the outset the judges held the position that they would be unwilling to convict someone for minor offenses such as smoking or eating on the Metro system. WMATA officials then gave a presentation of their philosophy and rationalization for enforcing such rules. They also prepared a slide show illustrating dirty and graffiti scarred new stations at another system where such rules were not enforced. At the close of the meeting 15 of the 16 judges agreed to support WMATA's efforts, and the result has been an effective enforcement program.

Efforts have been made to inform the public as to the existence and content of transit ordinances. Passengers on BART are frequently reminded by means of signs and announcements of activities that violate transit ordinances. RIPTA passengers were made aware of a new driver assault law through posters and newspaper ads.

Some broad security problems have been addressed through legislation introduced at the federal level. For example, federal standards exist to facilitate the identification of stolen motor vehicles and parts. The Federal Motor Vehicle Safety Standard, "Vehicle Identification Numbers," establishes requirements for vehicle identification numbers to be affixed to motor vehicles. A uniform national numbering system facilitates the location of stolen vehicles by allowing for the use of computers to help determine whether a particular vehicle has been reported as stolen.

In March 1983 legislation was introduced to substantially strengthen these standards. H.R. 2235 would improve identification numbering systems for motor vehicles and their major parts, increase federal criminal penalties for trafficking in stolen motor vehicles and parts, and establish motor vehicle security standards that provide for the identification of the major components of a new vehicle.

4.7 EDUCATION AND PUBLIC RELATIONS

There are various types of programs that transit systems use to improve public awareness of security issues and responsibilities in mass transit. These programs include visits to schools, community involvement programs, formal relationships with the media, and employee training.

4.7.1 School Programs

A number of transit systems utilize school programs to influence the behavior of children who ride on the system. A "Ride With Pride" program at BART teaches children how to ride and respect the transit system. At MBTA, the communications officer gives a slide presentation to school children illustrating the hazards of missiling and trespassing on transit property. Schools located near transit stations are given priority for this presentation. At RIPTA there is close cooperation between the transit system and the schools concerning the apprehension and punishment of graffiti offenders. School officials inspect buses before they depart from the school and also help RIPTA gain restitution from vandals. Finally, NJT-Rail has a School Safety Program in which a transit officer visits the schools and talks to the students about safety and the effects of vandalism. This program is capable in reaching as many as 800 students per day.

4.7.2 Community Programs

Community programs are another important public relations area at many transit systems, although some systems are more active than others. While a few systems will provide speakers for community meetings only if requested, many transit systems actively seek contact with community groups. For example, STM is planning to hire local youths over the summer in an attempt to foster better relations with the neighborhood and promote a feeling of involvement with the transit system .

The NJT-Rail police department is preparing to embark on a major crime prevention program, the purpose of which is to create an image of safety and security on the system, thereby increasing ridership and revenues. The program will consist of an expansion and modernization of the School Safety Program, a public relations campaign aimed at riders to make them more security conscious, and an educational program directed at transit employees to increase their security awareness. "McGruff the Crime Dog" will be used as a symbol throughout the program. Developed by the National Advertising Council, "McGruff" is a cartoon figure similar to Smokey the Bear with a national recognition factor.

In 1982 the WMATA police developed a program designed to improve the police officer's community image. The program involved the free distribution of Washington Redskins football cards that have an anti-crime message printed on the back. Youths were encouraged via advertising to approach officers and ask for the cards. The program, funded by private industry, was repeated in 1983. The NYCTA anti-crime unit conducts an extensive program to educate the public regarding subway crime and precautions they can take to safeguard themselves. One element of the program is a slide show which includes crime prevention tips such as "Don't display gold jewelry" and information on NYCTA security features including off-peak waiting areas, passenger emergency phones and flashing emergency lights on buses. This slide show is presented at community meetings throughout the city.

AC Transit conducts a "Community Values Program" directed at gang youths which sponsors community programs and hires a few youths from each neighborhood hoping to reduce gang activity on the buses through peer pressure. The program not only employs youths at AC Transit, but will attempt to place them into any available jobs. AC Transit claims that the "Community Values Program" is responsible for a significant reduction in gang activity on transit vehicles.

Finally, SCRTD has a variety of programs conducted by its Community Relations Department. The most publicized program is "Operation Teamwork," a community involvement program designed to fight crime. As part of this program, SCRTD staff work closely with law enforcement officers, elected officials, business and community leaders, and educators to encourage both respect for the law and the use of crime prevention activities.

4.7.3 Media Relations

The preference at most transit systems is to keep information relating to transit security violations out of the media, fearing that reports of such incidents will increase the public perception of a crime-ridden mass transit system. Contact with the media is generally the responsibility of a public relations department at large transit systems and higher level management officials at smaller systems. NYCTA has a public relations officer whose primary responsibility is to deal with the media. Since the media typically gives much

play to transit crime, NYCTA attempts to counter this tendency to exaggerate security violations by maintaining an open line to the media and supplying accurate information.

4.7.4 Employee Training

Some transit systems provide public relations training for their vehicle operators. Bus systems that have problems with driver assaults have experimented with programs designed to teach operators how to handle potential assault situations. In Pittsburgh, PAT used such a program to help significantly reduce assaults on drivers.

NYCTA offers a general operator training program aimed at reducing bus driver stress. Program participation is particularly encouraged for operators who have a history of passenger complaints or accidents. The two day course, which includes role playing exercises, demonstrates the advantages of being courteous and pleasant. Each year 1500 of the 9000 NYCTA operators enroll in the course.

4.8 MISCELLANEOUS SECURITY PROGRAMS

4.8.1 Guardian Angels

The Guardian Angels are a volunteer community group whose goal is to promote a sense of security in high crime areas. Local units, which patrol streets, housing developments and transit systems, have been formed in a number of major cities. Their activities on mass transit are confined to a relatively small number of larger transit systems. The transit systems do not enter into formal agreements with the Angels, and in most cases they require the Guardian Angels to pay a fare to enter the system. Transit system experiences with the Guardian Angels has been mixed. In some cases, they are regarded as a nuisance or worse. In other cases, they are considered a community asset.

4.8.2 Anonymous Information Programs

A number of transit systems belong to the WETIP program. This is a community involvement program in which citizens are encouraged to anonymously

report wrongdoings to security authorities. If the reports are substantiated, the citizen qualifies for a financial reward. Transit experience with WETIP is relatively recent and conclusions cannot yet be made concerning its effectiveness. BART participates in WETIP, however officials have mixed emotions about the program since only two rewards for information have been granted to date and most calls prove to be unusable. The number of calls received tends to vary with the amount of publicity given to the program. AC Transit, SCRTD, WMATA and MUNI have recently begun to participate in WETIP and NJT-Rail is studying the possibility of joining.

Some systems, in lieu of or in addition to WETIP, have their own anonymous information programs. SCRTD has a program for reporting internal theft, though few reports have been received. BART has a program which awards $100 to passengers or employees who identify security violators. Other systems, while not soliciting passenger information, have received phone calls from riders who have witnessed wrongdoings. Both RIPTA and AC Transit have received unsolicited phone calls from passengers that have resulted in the apprehension of transit security violators.

Anonymous information programs are also used with success in private industry. At one firm, anonymity is guaranteed through the use of a dedicated telephone line that is only answered by the chief of security.

4.8.3 Accounting Records of Crime Costs

Few transit systems maintain records of crime impacts. With most systems only beginning to implement or plan for computerized crime record keeping, the handling of such records is a costly procedure. Those statistics that do get compiled usually relate to the type, location, time and perpetrator of a crime. Usually cost data are not included. However, one transit system, STM, is beginning a cost accounting program. The maintenance department at STM has started to code vandalism repairs on their work orders for torn seats, broken windows and other types of vandalism. This information will provide the basis for a security data base to identify the real cost of vandalism.

4.8.4 Locked Parking Lots

Security of automobiles is a problem at many transit park-and-ride lots. In Houston, theft and burglary of automobiles parked in commuter parking lots led transit officials to experiment with locked parking lots. The parking lots are open to the public during the daily commuter rush hours. During the remaining hours of the day, the parking lots are locked preventing access by the public. If commuters require access to their vehicles during these hours, a phone call provides access to the parking lot.

Officials in Houston report favorable results for the experiment. There has been a significant decrease in parking lot crime, and the system has received very few calls from commuters who require early access to their cars.

5. POTENTIAL FOR TRANSIT SECURITY IMPROVEMENTS

Previous sections of this report have indicated the nature and extent of transit security problems, and have described programs and technologies used to promote transit security. There remain, however, questions regarding the selection and implementation of crime countermeasures at transit systems. Why do security problems exist given the range of countermeasures available? Are there problems for which adequate countermeasures have not been found? When and where should specific countermeasures be employed? This section addresses these questions and related issues by first considering the relationship between problems and countermeasures, and then considering the information and process needed to select specific countermeasures.

Information regarding transit security problems, collected through both site visits and published reports, indicates that there are large differences among transit systems in the types and rates of transit crime. A number of variables seem to influence these variations including the number and type of passengers served, the size and crime rates of the areas serviced, and the mode of transportation provided. For example, it was noted that transit systems located in densely populated areas seem to have greater crime problems in terms of both frequency and severity. However, distinctions in crime rates and types are also evident among systems with similar characteristics. These distinctions seem to be primarily a function of the particular crime prevention procedures and technologies utilized by each system.

To illustrate this point, consider two large inner city bus systems (A and B) that differ markedly in the effectiveness of their revenue security. System A uses out-dated, non-registering and often defective fareboxes that are easily violated by the vault pullers, and losses are suspected. Use of revenue handling equipment that is easily violated conveys to the employees responsible for cash handling that System A is not seriously concerned with revenue security. Conversely, System B has installed a modern registering fare collection and handling system which prevents employees from gaining access to cash, thereby foreclosing many opportunities for employee revenue theft. Through the use of

this equipment, System B has created the impression that revenue security is a major concern and employee skimming will not be tolerated. Thus security differences between the two systems relate not just to demography, geography and general crime rates but to the utilization of a particular security technology. As illustrated by this example, security problems can be controlled with the use of different technologies or procedures. With the proper mix of labor, technology and procedures, transit crime is generally controllable as evidenced by the variations in rates for specific crimes among transit systems.

Given that crime is controllable, methods are needed for selecting appropriate countermeasures. A critical issue is not matching solutions to problems, but determining whether particular solutions are cost-effective. Consider, for example, countermeasures to prevent bus driver assaults. At one extreme, bus driver assaults can be eliminated entirely if each operator is accompanied by an armed police officer. This solution is obviously financially untenable, but there remains the question of determining the appropriate level of police protection. On a more moderate scale, a program of driver training to cope with potential assault situations, combined with more effective police patrols and communication and surveillance equipment can significantly reduce the seriousness of this crime category.

When totalling the benefits to be accrued from either a technological or procedural change, it is important to account for social as well as economic gains. Using the example of on-board cameras designed to control anti-social behavior on buses, the decision whether to install the cameras hinges on a comparison of the costs of installing the cameras versus the benefits to be gained from this additional form of protection. The benefits are both financial and social; the transit system gains financially through increased ridership revenues and reduced repair costs, and the overall sense of security on the part of transit riders is improved.

Deficiencies in transit security exist not only in the discovery of solutions, but also in the methods used to determine if, when, and where to implement particular solutions. What is lacking are data with which questions of implementation can be quantitatively and rationally answered. For example, a

transit system can make a rational decision regarding the purchase of new fare collection and handling equipment only if it has an approximate quantification of the losses currently being suffered and the purchase and maintenance costs of the new equipment. Since these data are not readily available, the system may be overlooking an important potential source of additional revenues by underestimating the current amount of losses. In another example, a transit system can rationally determine how many resources to expend for the protection of passengers from anti-social behavior on vehicles and at stations only if it understands the financial and social consequences of such behavior.

To alleviate this deficiency in transit security, further studies are needed on the financial and social costs of transit crime, including the impact of transit crime and of various security improvements on ridership, and the impact of particular security procedures or technologies on crime. One approach to this research would be to undertake case studies at various transit systems. These case studies should be used to acquire data concerning the costs and benefits of the implementation of particular technologies and procedures. The acquisition of such data would be an important step in increasing the effectiveness of decisions regarding the implementation of different security measures.

6. THE PROCESS OF CHANGE IN TRANSIT SECURITY

This section describes factors which promote improvements in transit security procedures and technology . It also discusses mechanisms by which information is disseminated within the transit industry. Information on new technologies and procedures is a necessary ingredient in the process of change.

6.1 IMPETUS FOR CHANGE

In theory, when a security problem exists on a transit system, management should receive feedback on the problem and work towards a solution. Often, however, information is not available or is not communicated to management. Sometimes a problem which could have been stopped at an early stage becomes a major crime wave before management can respond. In other cases, management may ignore a known problem because its solution seems too costly, not worth the effort, or too disruptive of the status quo.

6.1.1 Response to Crisis

Sometimes security measures are instituted in response to a particularly disturbing crime or a sudden increase in the crime rate. Often the media or an outside interest group is instrumental in demanding action. In Providence, assaults on RIPTA drivers led to pressure on the state legislature, which resulted in a law making bus driver assault a felony. At WMATA, a wave of station break-ins led to the implementation of a mobile station patrol. The positive side of this reactive stance is that there is usually a good match between problem and solution. The negative side is that solutions may be directed at an isolated problem where a systematic approach might be better in the long run.

6.1.2 Innovative Personnel

A new general manager or security chief can bring fresh ideas on transit security to a system. The new general manager of NJT's Bus Division had

previously worked at SCRTD and NYCTA. When he took over his current position, the only security presence was a private firm hired to provide "spotters" to observe driver performance. This individual got support to establish a security department. The 8-person department, which handles internal and external security, is conducting a revenue security study using UMTA funding.

A new security chief can bring valuable experience from previous police work. At the MBTA, the new police chief was formerly a superintendent of the Boston Police Department. His prior experience is helpful in implementing a new anti-crime package, particularly in enlisting local police departments to undertake the routine patrol of MBTA stations in their jurisdictions.

6.1.3 System Modernization

Transit system construction and modernization projects create the opportunity to do comprehensive transit security planning. If careful planning is done prior to construction, transit security can be enhanced at little or no additional cost. Some options such as the security-conscious design of a station may have great security value while costing little if any more than an alternate design.

Although new construction allows the greatest options, rehabilitation also provides opportunities. As part of their rehabilitation of Newark's light rail system, NJT-Bus plans to install CCTVs and passenger emergency phones in stations.

Another aspect of modernization is the trend toward computerization of transit system operations. This conversion offers the opportunity for computerization of security functions as well. Items that lend themselves to computerization include incident statistics, criminal (offender) records, and revenue audit trails. Such computerization could lead to a significant increase in the effectiveness of transit system security.

6.2 SOURCES OF INFORMATION ON TRANSIT SECURITY TECHNOLOGIES, PROCEDURES AND PROGRAMS

To implement transit security programs, those responsible need information on available options. Some of the sources for such information are described below.

6.2.1 APTA/UMTA Information Dissemination

The American Public Transit Association's (APTA) Transit Security Committee meets several times a year at various locations around the country. At these meetings, transit system representatives describe the kinds of security projects they are working on, and suppliers describe various security-related products. The APTA Transit Security Committee has published a Transit Security Guidelines Manual, presenting various approaches to transit security problems based on the experiences of transit systems. The manual, first published in 1979, currently is being revised.

Workshops focused on particular security problems common to more than one system are another technique for information dissemination. An interesting variation of this approach is the recent workshop held for vacuum system technicians. Information was shared on the replacement of components and the improvement of security for the vacuum system. Such sharing is important since many transit systems have made their own ingenious modifications to standard equipment. This was the first "blue collar" workshop that UMTA has sponsored.

UMTA has sponsored a series of peer reviews on various topics to help in the planning and design of the new Los Angeles subway system. The peer review boards include transit system representatives from around the country. In January 1983 a security peer review board met to discuss security aspects of the new system. Similar peer reviews are planned for other new rail transit systems.

The peer review concept has been expanded (or perhaps one should say contracted) to the notion of a mini-peer review. This concept has been discussed by APTA Committee members. On invitation from a transit system with a known or suspected security problem, a small peer review group would visit and give advice on programs or possible solutions to the problem. Such a group review could provide immediate, focused assistance in solving the problem at hand.

Another outlet for transit security information is provided by the UMTA-sponsored Mass Transit Security Courses held four times a year at DOT's Transportation Safety Institute in Oklahoma City. These week-long courses cover all aspects of security, including protection of passengers, facilities and revenue.

UMTA-sponsored research at TSC has resulted in a series of technical reports in areas such as the impact of CCTV in transit stations, passenger perceived

security on transit systems, and the prediction of security requirements for automated guideway transit systems. These reports by TSC are distributed to transit system personnel and other interested parties.

UMTA Section 6 Research, Development and Demonstration grants can be used to test transit security equipment or procedures at individual transit systems. These grants provide the impetus and resources for a system to undertake a security project that otherwise might not have occurred. In return for funding, UMTA acquires valuable information on the cost-effectiveness of the measure being tested, which in turn is disseminated to transit systems around the country.

6.2.2 Private Industry Information Dissemination

One way that manufacturers and suppliers of transit security products distribute information is through participation in APTA Transit Security Committee meetings where they give presentations on how their products can improve security. In many cases suppliers work directly with a transit system to solve particular security problems. The MBTA has engaged the services of MEDECO, a lock supplier, to solve problems they have with farebox and turnstile security. Various security trade journals describe new security products. NYCTA became interested in using a "light cocoon" security system for protecting lay-up trains after reading about it in a security magazine.

6.2.3 Transit System-Initiated Exchanges

Transit personnel often initiate their own contacts with other transit systems or related organizations. The Assistant Director of Revenue for the NYCTA visits other counting rooms, transit and nontransit, out of professional interest. The Assistant Chief of NYCTA's Property Protection Division visited Riker's Island Jail to get ideas on fencing systems to keep graffiti artists out of rail yards.

In the San Francisco Bay Area, transit systems meet regularly to discuss security issues. The MBTA has established a Revenue Security Committee to discuss security issues within their own system.

Transit police chiefs are often members of associations, such as the National Association of Chiefs of Police, through which they can exchange information with others in the security profession.

7. CONCLUSIONS AND RECOMMENDATIONS

While the primary purpose of this report is to describe the current state of transit security and not to evaluate specific programs and technologies in use at transit systems, a number of general conclusions and recommendations are appropriate.

CONCLUSIONS:

- There is substantial evidence that transit security represents a large, multi-dimensional problem which seriouisly detracts from the continued viability of public transportation.
- The financial and social costs of transit security violations are borne by transit riders as well as by the public at large.
- Lack of quantification is a problem which pervades the area of transit security. Most transit systems record individual crime incidents, but few compile aggregate crime statistics. Few systems maintain statistics on losses from fare evasion, revenue theft, property theft, or vandalism.
- Better quantification would make transit officials more aware of existing problems and would allow them to make more rational decisions regarding the implementation of new procedures, programs and technologies. In addition, it would allow more precise estimation of the dimensions of the transit security problem on a national level.
- Most transit security activity is reactive, responding to a particular problem. Programs that deal systematically with problems and solutions are more the exception than the rule.
- Although some information sharing does occur, many systems implement security countermeasures without interaction with others in the transit industry. More information sharing among transit officials would help to disseminate innovative security ideas and techniques.
- Significant improvements in security could be obtained by fuller utilization of those countermeasures already developed and available to transit systems.

RECOMMENDATIONS:

- UMTA should promote greater quantification of transit security information by encouraging systems to maintain comprehensive automated records and by encouraging some form of national reporting system for transit crime statistics.
- UMTA should conduct further studies to (1) quantify the financial and social costs of transit crime (2) identify countermeasures to address transit crime, and (3) establish the impact of particular security countermeasures on transit crime.
- UMTA should undertake cost/benefit studies to determine the relative value of various security countermeasures thereby assisting transit systems in deciding which measures to implement in "real world" situations.
- UMTA should act to enhance the exchange of information on transit security problems and countermeasures within the transit industry.

APPENDIX A: SAMPLE OF QUESTIONNAIRE USED AT TRANSIT SITE VISITS

INTRODUCTION

- (General) What are your major (categories) of security problems? How do you deal with them?

1. SECURITY PERSONNEL AND ORGANIZATION

- ORGANIZATION
  - Number of personnel
  - Number of personnel by title or function (detectives, patrol officers, office staff)
  - Who supervises each function? (name, phone number)
  - How was the size of staff determined?
  - Who does the chief of security report to? (organization chart)
  - Does entire security function rest with transit personnel? (outside contractors, joint activities with locals)
  - Security function outside of the security department (undercover operations, treasury/revenue)
  - Background of personnel
  - Hiring practices (details)
  - Training program (details)
- SECURITY MANAGEMENT ACTIVITIES
  - Long or short range security plan (copy)
  - Standard procedures for various incidents: hostages, disasters, rapes (copies)
  - Communications with outside sources: (benefits)

    Local/State Police

    National police agencies

    Security personnel at other transit systems

Local community groups

Management tools used to run (MIS, AVM) the security system

- POLICING ACTIVITIES
  - Responsibility and functions of personnel?

    Patrols/Guards

    Undercover

    Detectives

  - If joint activities with local police, how are activities coordinated?
  - What type of equipment is used by security?
  - Do security personnel have arrest authority?
  - What is the process follwing arrest?

2. EQUIPMENT AND TECHNOLOGY

- CCTV
  - Cost of system (approximate)
  - Are cameras hidden or open?
  - Are recordings made of the observations?
  - How long are they kept?
  - Are the cameras used in conjunction with two way communication systems?
  - Are they used in situations other than to observe crowds or revenue functions?
  - In your opinion, does the public perception of security increase or decrease when cameras are in operation?
- COMPUTERS
  - Application to security?
  - Interconnected to other system(s)?
  - Cost?
  - Personnel?

Operating
Maintenance

- How is it accessed (local/remote)?
- Data bases (type) and software used?

- AVM SYSTEMS
  - Where employed?
  - Type of message transmitted (coded, alarm, etc.)?
  - Does system have automatic passenger counters?
- SILENT ALARMS
  - Describe how system is utilized (revenue counting, on vehicles, etc.)
  - Is system activated automatically, manually?
  - Is system interconnected to other alarm systems and/or police facilities? (i.e.: Is system priority oriented?)
  - Estimate of the cost to install and maintain the system.
- PASSENGER ALARMS
  - Describe the passenger alarm device and/or system in use at this facility.
  - What was the motivating factor that determined the need for installing this system?
  - Estimate the cost of maintaining and operation of this system.
  - In your opinion has this system increased real or perceived passenger security since it has been in use?

3. REVENUE SECURITY

- GENERAL DESCRIPTION OF FARE COLLECTION SYSTEM
  - Daily revenue?
  - Dollar bills/day?
  - Payment system (entering, leaving)?
- ON BOARD FARE COLLECTION
  - What type of fareboxes are in use (nonregistering, mechanically registering, electronically registering, bill transport)?

- What type of fare media are accepted on board (coins, bills, tokens, ride tickets, transfers, passes)?

- How are dollar bills handled (driver keeps bills, driver puts in farebox, passenger puts in farebox)?

- Are jammed fareboxes a problem?

- What is the standard procedure for dealing with jammed fareboxes?

- IN-STATION FARE COLLECTION (RAIL)

  - What type of turnstiles are used in the station?

  - What type of fare media do these turnstiles accept (coins, tokens, transfers, passes)?

  - What other types of fare-related equipment are found in the station (ticket vending machines, token vending machines, change makers)?

  - Are there problems with robberies, equipment break-ins?

  - What countermeasures are being used (CCTV, alarms, hardening of equipment)?

- FARE EVASION/COUNTEREITING

  - What is the extent of the fare evasion problem ($ loss estimate)?

  - How is fare evasion dealt with by drivers (driver discretion, driver requests payment, confrontation)?

  - Are any fare media counterfeited?

  - What countermeasures are taken against counterfeiting?

  - Is there a "half dollar bill" problem?

- REVENUE TRANSFER/COUNTING

  - How is revenue transferred from buses to counting room?

  - Is a one-vault or two-vault system used?

  - What controls are there on empty vaults?

  - What security measures are used in the counting room (high visibility, alarm system, CCTV, control of keys)?

  - What security measures are taken to protect revenue prior to bank deposit?

- OVERALL ACCOUNTABILITY OF REVENUES

  - Are revenues checked by route or other aggregate on a daily basis? On a regular basis? On a sample basis?

  - Do discrepancies ever exist between revenues counted and bank deposit statements?

  - Are independent audits done of the revenue collection system?

  - What control are there over the sale of passes (tokens, ride tickets) and revenues received?

- ENFORCEMENT OF REVENUE COLLECTION AND REVENUE SECURITY

  - What actions are taken against fare evaders?

  - What actions are taken against employee theft of revenues?

4. INTERNAL INVESTIGATIONS

   - Crimes/problems addressed? (larceny, bribery, etc.)

   - How are investigations organized?

   - Who initiates? Who supervises?

   - Are outside agencies used?

   - Any effort to identify potential crime-risks among employees?

5. LEGAL SYSTEM RELATIONSHIPS

   - Are existing laws and ordinances adequate?

   - Are riders aware of relevant laws and ordinances?

   - Are repeat offenders identified?

   - Are agreements with municipalities adequate?

   - Is the arrest-prosecution-judgement-sentencing/fining process satisfactory?

6. EDUCATION AND PUBLIC RELATIONS PROGRAMS

   - Who (if anyone) has job of education and public relations?

   - What are goals/objectives in this area?

   - What programs are used? (schools, community groups)

- Any effort to educate local law enforcement agencies regarding transit security problems?

- Are transit operating personnel given any security training?

  What is its nature? (define rules, how to respond to minor offenses?)

7. MISCELLANEOUS SECURITY PROGRAMS

- Existence and role of Guardian Angel-type community action group?

- Experience with community crime-reporting systems? (WETIP)

- How are records of crime and vandalism losses collected and accumulated?

- Who/how are crimes reported? (assualts, rape, etc.)

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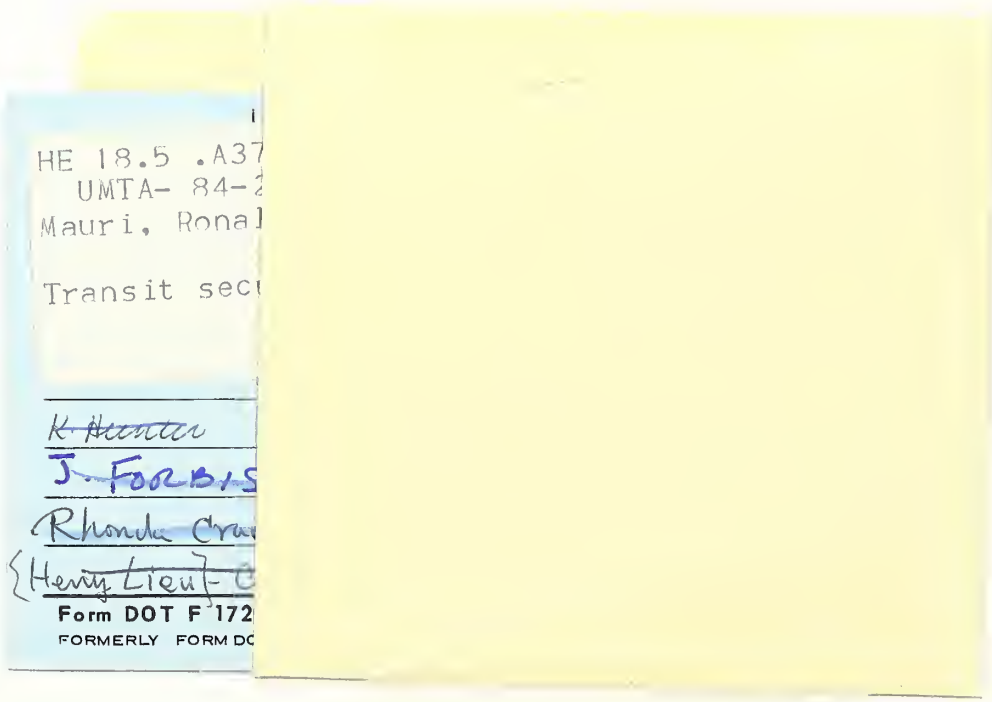
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